THE EVOLUTION OF NON-MILITARY NUCLEAR AND RADIOLOGICAL PREPAREDNESS BY THE U.S. GOVERNMENT DURING PERIODS OF TRANSITION

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Abstract

This paper is about the evolution of nuclear and radiological preparedness primarily in the U.S. over the last 50 years. In the first chapter, the reader is provided the understanding that non-military nuclear and radiological preparedness from a public standpoint during the 1970s through the end of the century was reactive in nature due to the infancy of the new field with nuclear and radioactive uses first starting in the 40s, the creation of new agencies and real world events providing lessons learned and best practices. The second chapter focuses on radiological security and its life cycle in the U.S. starting in the early 2000s to a point of maturity today. The final chapter provides the reader context on how one might determine if government preparedness is effective with the use of tabletop exercises. **Primary Reader and Advisor:** Dr. Dorthea Wolfson.

Dedications and Acknowledgments

The work of this thesis spanned 10 years and involved several changes in my professional and personal life. Dedication to reaching my goal of completing this work goes to my son Noah and my future daughter who is set to be born in December as I was determined to demonstrate to my kids that one should complete something they start. Secondly, the support of my second parents Dov and Elma Levy were instrumental in challenging me over the course of these past 10 years professionally, academically, and personally. Lastly, but not least, I want to acknowledge my wife Anna who supported me through completion, my brother for great conversation involving writing, and so many of my friends and work colleagues that assisted me throughout this work.

Preface

When I started this paper and submitted one chapter over eight years ago to my professor at Johns Hopkins, I never fully grasped the idea that I might actually be able to bring legitimate and robust insight into the topic in which I would be writing about. At the time, I was working as a contractor to the National Nuclear Security Administration (NNSA) with just around three years of experience conducting exercises and working with foreign as well as U.S. Federal, state and local government agencies on nuclear and radiological preparedness. I submitted my chapter on tabletop exercise effectiveness and felt as if it was a true contribution to the preparedness exercise community for the time. Over the next eight years, I continued small bits of coursework to reach present day. In 2019 and 2020, close to eight years later, I have completed my work on this paper and bring a significantly different perspective to the first two chapters. Having started and led a company during this same period that provides consulting in Weapons of Mass Destruction and nuclear and radiological preparedness, I both admire some of the aspects of forward thinking that was presented at the time in 2012, but also reflect on the naiveite of the student with little experience that I was. For this reason, I have left chapter 3 predominately untouched other than some minor expansion of thought. As I work in this field today, I plan to continue my research on chapter 3 at a later date as it will benefit me personally, my company, and the exercise preparedness community.

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Introduction

In this paper, I will look at the evolution of nonmilitary nuclear and radiological preparedness in the U.S. government during periods of transition. This paper will attempt to illustrate the progress the U.S. has made from 1970 through today in the infrastructure, policy, and actual response related to nuclear and radiological preparedness. Throughout the paper, I will use a variety of metrics, charts and interviews to give the reader a better perspective on how preparedness evolved.

Chapter One, *Was the 30-year period prior to the end of the 20th century (1970-2000) evidence that the world's governments were not ready or prepared to effectively respond to nuclear and radiological incidents?,* starts by taking the reader through a brief history of the transition of nuclear and radiological preparedness from a military responsibility, and then transitioning to the public sector's role. The peaceful use of nuclear power and radiological patient and industrial uses commenced in 1942 with the first self-sustaining nuclear reaction[1]. At this time, the world and specifically the U.S. were very inexperienced at preparing for incidents involving nuclear and radioactive material as it was a new threat. I present the 1970s as the decade of catalyst change in nuclear and radiological preparedness that will be seen in the subsequent years to follow.

Historical events provide context to the evolution of the U.S. preparedness community and policy. Throughout the chapter, I look to illustrate the point that our government was reactive in nature to nuclear and radiological incidents and were driven to change infrastructure, policy, and response by real-world incidents. A

[1] Department of Energy. History of Nuclear Energy. Accessed 04/19/20.

timeline is provided at the close of the chapter to show this over the course of 30 years. I submit that the turning point of the U.S.'s reactive shift to a proactive government was made in the mid-90s with steps being taken by the federal government in law and guidance.

Chapter 2, *How has radiological security evolved since the turn of the century?,* shifts the focus from both nuclear and radiological preparedness to just radiological security. This is intentional for a couple of reasons. In the late 90s and early 2000s, terrorism and the use of WMDs became of great concern worldwide. By its nature, the nuclear threat will always pose a greater consequence if one were to compare an attentional attack versus a radiological attack. What was overlooked up until the start of the 2000s (at least in all available information to the public) was the radiological threat from a security incident. Although the physical consequence impact from a detonation of a radiological device vs. nuclear device would be exponentially less, the probability and availability of radioactive material to terrorists was and still is significantly greater.

This chapter aims to illustrate how security, response, policy, and infrastructure around radioactive material evolved from 2000 through today the events of 9/11 until present day. In addition, this chapter will also address real-world threats provided the U.S. government the information to understand that the threat from radioactive material being used to harm a population is possible and technically feasible. The goal of this chapter is also to illustrate radiological security in the U.S. during the last 20 years as a life cycle. If the early 2000s was the introduction of the problem and solution, the mid 2000s were the growth stage and the last five years

have been the maturity stage for the U.S. government. At the end of this chapter, the reflection on 20 years being a short time in comparison to preparedness to other threats is made…as it is acknowledged that we are still in an infancy phase with regards to this field as a whole, not to mention preparedness for it.

Lastly, Chapter 3, *Tabletop exercises: Are they effective?* transitions the topic from radiological security and preparedness to what is an effective method of testing preparedness. Because the U.S. has shifted its approach to an all-hazard mindset, it is often looked at to prepare organizations for a multitude of disasters using specific scenarios to test that genre of a disaster. This chapter will not just look through the nuclear and radiological preparedness lens, but the entire all-hazard lens to get a better picture as if using tabletop exercises are effective to test preparedness in planning. The chapter will identify the various exercise methods and how they are used and will conclude with suggestions on how using quantitative metrics can better help determine effectiveness to discussion-based exercises. Although this chapter was written, accepted for submission, and graded eight years ago, its innovative rubric proposal, which was designed to assist agencies, organizations, and planners to get the most benefit out of tabletops exercises, is even more relevant today if methods to gauge exercise success or failure are not being implemented.

At the conclusion of the chapter, I propose using this rubric to help planners drive and measure the goals of each exercise. This rubric can be used today and moving forward. In the last three to five years, organizations and exercise planners have started to use and incorporate some of the methods of quantitative

measurement with success. I believe this is an outcome of my company's and its peers' efforts that have identified this need and this gap. This view has been reinforced by the U.S. Congress demanding more confidence in programs delivering results.

From an overarching assessment, this paper should provide a holistic view of nonmilitary, nuclear and radiological preparedness over the last 50 years. It will also show the importance of our country remaining vigilant and proactive when it comes to potential threats. During the completion of this paper, the U.S. and the world were in the middle of the Coronavirus pandemic, further illustrating a fresh look at how governments react, respond and reflect. Much will be learned and changed by the U.S. going forward following a devolution to somewhat of a steady state with regards to operations and preparedness following the pandemic. This could prove to be a very relative comparison that can be made to this paper as we continue to evolve our preparedness and response to all-hazards similar to what we have done over the last 50 years with nuclear and radiological preparedness. Furthermore, the use of tools, plans, training, and exercises that are effective will be critical to the prevention, protection, response, mitigation, and recovery of future threats that face the U.S.

Chapter 1

Was the 30-year period prior to the end of the 20th century (1970-2000) evidence that the world's governments were not ready or prepared to effectively respond to nuclear and radiological incidents?

Since the 1970s (and for more than a century before that), governments and private organizations have been preparing for general disasters through various forms of training, drills, and exercises. Nuclear and radiological incidents were a relatively new addition of disasters that had to be taken into consideration with their widespread use in commercial, public, and military sectors. This chapter starts with the 1970s since the military handled nuclear and radiological preparedness for much of century. A paradigm shift occurs to the public sector in the 1970s. Over the next 30 years (1970-2000), a number of significant events took place that did not involve nuclear weapons and demonstrated that the U.S. government's interagency response during this time was reactive in nature. This reactive approach highlights that actual events provided the greatest impetus for developing policies that dictated roles and responsibilities during a nuclear or radiological crisis.

Moreover, the U.S. and other countries faced a multitude of nuclear and radiological incidents prior to the turn of the century that varied in scale and magnitude. While the first public use of nuclear or radiological material was used for military applications, peaceful uses for this technology began to proliferate; nuclear power plants were able to provide nations with an additional option to meet their energy needs, the medical community began to use nuclear medicine and radiological materials (cancer treatment, for example), and industrial uses such as

food and equipment sterilization and well logging were additional sectors that began to invest heavily in the peaceful use of nuclear and radiological material.[2]

However, with the proliferation of both military and peaceful applications of nuclear and radiological material, the risk posed by this material increased, as did gaps in the U.S. government's and international policies to an effective response involving these materials. In this chapter, I will look to illustrate how unprepared the world, and more specifically the U.S., was to respond to incidents involving nuclear material, demonstrated by reactive responses instead of proactive approaches.

This chapter will also provide some background on significant nuclear and radiological incidents that shifted the approach to preparing for a crisis involving nuclear or radiological material by providing real-world experience and valuable lessons learned. The policies guiding the U.S. government's response to a nuclear or radiological incident have significantly changed over the last fifty years due to real-life events. As reactive measures, the creation of laws and policies and understanding the need for realistic exercises were the results of actual events and the complexities involved. To illustrate this, this chapter will take a brief look at the history of nuclear and radiological preparedness over a very important period from the 1970s to the end of the 1990s. During this time, several significant events occurred that shifted the entire nuclear and radiological response landscape. Additionally, the first-hand perspective and recollections of individuals directly involved in the development of the U.S. government's nuclear and radiological

[2] Nuclear Regulatory Commission. https://www.nrc.gov/about-nrc/radiation/around-us/uses-radiation.html. 2017

preparedness and response policies will be used to demonstrate how incidents forced the U.S. interagency to constantly evolve in order to most effectively address this complex issue. For this chapter, I have interviewed top officials and subject matter experts (SMEs) throughout the nuclear and radiological interagency that worked during this period. These officials and SMEs worked at the White House, the Federal Bureau of Investigation (FBI), the Department of Energy/National Nuclear Security Administration (DOE/NNSA), INTERPOL, Sandia National Laboratories (SNL), the Department of State (DoS), the Department of Homeland Security (DHS), the Federal Emergency Management Agency (FEMA), and the Nuclear Regulatory Commission (NRC). These individuals were both Federal officials and contracted specialists that assisted the government; the officials interviewed had significant roles including Deputy Under Secretary, Nuclear and Radiological Unit Chief, Senior Health Physicist, and others. Furthermore, a timeline will be used to illustrate the order of events and provide additional context as to why changes in the U.S. government's response policies were made.

As numerous agencies are involved in an actual response to a nuclear or radiological incident, only a few agencies in this chapter will be highlighted. This is because there is an overlap in response functions during the response to a nuclear or radiological incident depending on numerous factors. Similarly, this chapter will explore and discuss trends or political reasons that forced change. A goal of this chapter is to provide a holistic view of the U.S. government's evolving nuclear or radiological response policies from some of the top experts and how the continuing

evolution of these policies occur to identify trends and emerging threats. This topic will be explored in depth in a subsequent chapter.

Background

The U.S. and other wealthy nations have been preparing for different disasters for well over a century. A bulk of the U.S. government's preparedness policies were initially developed by the Department of Defense (DoD) and their mission to fight in a broad spectrum of environments and threats. Because the DoD had the most experience handling preparedness, they led the U.S. government's response to nuclear or radiological incidents for much of last century up until the 1970s. In the 70s, non-military governmental agencies appropriated domestic preparedness to nuclear and radiological incidents from DoD.[3]

Before the 1970s, emergency preparedness planning functions were considered a part of national security duties that were established under the National Security Act of 1947. The National Security Act of 1947 shifted the responsibility of preparedness to the Office of Defense Mobilization (ODM). ODM consolidated with the Federal Civil Defense Administration to form the Office of Defense and Civilian Mobilization (ODCM), with responsibility for civil defense and emergency mobilization coordination in 1958. In 1961, OCDM was designated as the Office of Emergency Planning (OEP). OEP coordinated emergency preparedness activities, principally in areas of resource utilization, civil defense, economic stabilization, post-

[3] Department of Homeland Security, Civil Defense and Homeland Security: A Short History of National Preparedness Efforts, September 2006

attack rehabilitation, and government organization and continuity. OEP would be then designated as the Office of Emergency Preparedness in 1968.[4]

In the 1970s, the Robert T. Stafford Disaster Relief and Emergency Assistance Act created the system in place today in which a Presidential disaster declaration during an emergency triggers financial and physical assistance through FEMA. Commonly referred to as the Stafford Act, among other things it gives FEMA the responsibility for coordinating government-wide relief efforts.

On October 11, President Gerald R. Ford signed the Energy Reorganization Act of 1974. This act abolished the Atomic Energy Commission, the original agency that was created in 1946 to manage the development, use, and control of atomic (nuclear) energy for military and civilian applications,[5] and created three new Federal entities: the Energy Research and Development Administration (ERDA), the Nuclear Regulatory Commission (NRC), and an Energy Resources Council composed of the Secretaries of State and Interior, the administrators of ERDA, and the director of the Office of Management and Budget.[6] With regards to nuclear and radiological incidents, the Energy Reorganization Act of 1974 required the Administrator of ERDA and the Secretary of Defense to review the feasibility of transferring the military functions formerly vested in the Atomic Energy Commission to the Department of Defense or to other Federal agencies.[7]

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[4] Department of Homeland Security. Civil Defense and Homeland Security: A Short History of National Preparedness Efforts. September 2006

[5] Nuclear Regulatory Commission. https://www.nrc.gov/reading-rm/basic-ref/glossary/atomic-energy-commission.html.

[6] Department of Energy, A History of the Energy Research and Development Administration, March 1982

[7] Ibid

The possible transfer of these functions, which included weapon development programs, the control of highly sensitive nuclear weapon information, and certain nondefense related programs including the development and maintenance of naval reactors, space nuclear systems, military power reactors, and the production of special nuclear materials, reflected continuing congressional concern over the issue of civilian control of technology, information, and assets that had been primarily under the purview of the DoD. In January 1976, following a year of study, concern was raised about lack of focus being a detriment to a strong nuclear weapons program; this was partially owed to the split in the management and funding responsibilities between different agencies[8]. It was recommended instead that the nuclear weapon program and complexes be retained within ERDA, but have a budget of its own, separate from the budget for energy programs. The Assistant Administrator for National Security would be responsible for seeing that the weapon program received priority in the use of laboratories and production facilities, while nonweapon defense-related programs would be under the direction of the Assistant Administrator for Nuclear Energy. The unique capability of the weapon research laboratories to perform significant nonnuclear research in the energy development field was another factor in the final decision to leave the division of military application and the associated nuclear activities within the Energy Research and

[8] 25. Assistant Administrator for National Security to Administrator, April 16, 1976; Roger M. Anders, "The Office of Military Application," IODE History Series, Vol. 1, No. 1, Aug. 1980; "Funding and Management Alternatives for ERDA Military Application and Restricted Data Functions," ERDA 97, Jan. 1976; Section 307(b), Energy Reorganization Act of 1974, as reprinted in Compilation of Energy-Related Legislation, published by the House Committee on Interstate and Foreign Commerce, Aug. 1979, 376. (Hereafter cited as HCIFC, Energy Legislation.)

Development Administration.[9] An Interagency Committee on Radiological Assistance operated under an ad hoc arrangement until 1961 at which time a formal Interagency Radiological Assistance Plan (IRAP) was signed by the Atomic Energy Commission (AEC), (predecessor to the DOE), the DoD, the Department of Health, Education, and Welfare (DHEW), the Department of Labor (DOL), the Department of the Treasury, the Department of Commerce, the Office of Civil Defense Mobilization, the Federal Aviation Administration (FAA), the National Aeronautics and Space Administration (NASA), the Post Office Department, and the Interstate Commerce Commission. In 1973, the AEC, the DHEW, the Defense Civil Preparedness Agency (DCPA) (formerly Civil Defense), and the Environmental Protection Agency (EPA) signed an agreement to assist each other in responding to a radiological incident at a fixed facility.[10]

The AEC was responsible for maintaining the 1973 IRAP, which superseded the earlier 1961 agreement. The Energy Reorganization Action of 1974 abolished the AEC and created the Nuclear Regulatory Commission (NRC) and the Energy Research and Development Agency (ERDA, another predecessor organization to the DOE). The responsibilities of the AEC were divided between the two newly created agencies; this division became effective January 19, 1975 by Executive Order.[11] The NRC took the lead responsibility for planning and training and the ERDA had responsibilities for working with state and local governments to

[9] Ibid
[10] Federation of American Scientists. https://fas.org/nuke/guide/usa/doctrine/national/frerp.htm
[11] U.S. Department of Energy. The Atomic Energy Commission. July 1983

coordinate radiological capabilities. The Federal agency planning was further expanded to cover transportation accidents and the agreements were signed by the NRC, EPA, ERDA, DHEW, Department of Transportation (DOT), DCPA, Department of Housing and Urban Development (HUD), and the Federal Preparedness Administration (FPA).[12]

Patrick Daly, who held the position of Senior Military Advisor to the Ambassador at Large for Counterterrorism to the Department of State, shared his insights on the events and thinking that led to the creation of ERDA. His insights are worth quoting in full:

> "It started out with the Atomic Energy Commission, when the primary focus of the U.S. government was bomb creation and use during war time. This started to evolve with the increasing civilian use of radiological material; industries such as nuclear medicine, research reactors, things of that nature. So ERDA was created to evolve with the diversifying use of radiological and nuclear material, incorporating civilian uses and war applications. Then the oil crisis in 1979 happened, and then President Carter, being a former nuclear submarine officer, created the DOE. Carter had attended the Naval Academy with Admiral Hyman G. Rickover, who is considered the father of the U.S. Navy's nuclear submarine program. So, Carter, having this nuclear background, formed the Department of Energy. One of the accidents that occurred during Carter's tenure as President was an incident involving an intercontinental ballistic missile loaded with a 9 megaton nuclear warhead, about 50 miles outside of Little Rock, Arkansas. I was at the Pentagon at the time, and the whole Air Force operations system, it just went crazy because of this accident. The technicians at this missile facility dropped a wrench or socket or something and hit a fuel tank on the rocket and punctured it, and rocket fuel starts pouring out. They had to evacuate the silo. It was serious. I can remember going 24/7 at the Pentagon. A majority of the response to this accident was by the military. This policy started to change with the creation of DOE and the development of their response teams, the NEST [Nuclear Emergency Support Team] and REAC/TS [Radiation Emergency Assistance Center/Training Site]. The military kept the kinetic duties of the U.S. government's domestic response to nuclear-based attacks or incidents with specialized military units tasked with missions that are of national level

[12] NRC. **Backgrounder on Nuclear Insurance and Disaster Relief. May 3, 2019**

> importance until the FBI appropriated the domestic, armed response mission due to concerns about using Department of Defense forces on U.S. soil."[13]

Mr. Daly had provided great context that the transition and responsibility started to evolve that incident can take place out of war time scenario that would further the need for public agencies to be more involved in planning, preparing and exercising for nuclear and radiological incidents.

At around this same time, the Federal Emergency Management Agency (FEMA) and its preceding agencies were to cover any human-caused or natural events. Given the many years of congressional acquiescence in this administration of the Stafford Act, this administrative interpretation would normally be regarded as authoritative and correct. Prior to the Disaster Relief Act of 1974, legislation largely defined a "disaster" as an environmental event (a tornado or earthquake, for instance). But when discussion among policy makers was made regarding a nuclear disaster the consensus opinion was that Congress would take the lead to alleviate any suffering in such a situation. In 1974, the Stafford Act under consideration referred to the "natural" hazards that will be covered would also include "any one of a number of natural hazards or other catastrophes causing damage that requires emergency assistance."[14]This shifted the responsibility of FEMA, as well as provided authority, to support a broader scope to include the consequence aspects to a nuclear and radiological incident. Extensive hearings were held, which resulted in a focus on the aid needed during a disaster, not how the disaster was caused. To clarify whether the Stafford Act can properly be used to cover man-made disasters,

[13] Daly, Patrick. Personal Interview. March 20, 2020.
[14] 120 Cong. Rec. 4169. statement of Sen. Burdick, floor manager. 1974

a list provided by FEMA includes all the emergencies that have been covered since May 1, 1953, by the Stafford Act or its predecessors, which also includes human-caused disasters have been covered for as long as there has been specific disaster legislation.[15]

The inadequacies of 1979 and 1989: Addressing the threat posed by nuclear and radiological incidents.

A significant period to understand the evolving response to nuclear and radiological incidents is the ten years between 1979 and 1989. The world saw firsthand the impact of wide scale nuclear and radiological events that occurred outside of military applications. During this period, a domestic and an international nuclear reactor accident occurred, one of the biggest nuclear exercises ever conducted took place in the U.S., new policies were created to combat nuclear and radiological terrorism, and a radiological accident became a case study in the consequences that can result from the contamination of a wide area and population by radiological material.

In a 1977 agreement, or memorandum of understanding, the NRC agreed to notify the ERDA immediately of any emergency that may require its assistance, and ERDA agreed to provide Aerial Radiation Measuring System (ARMS) and Nuclear Emergency Search Team (NEST) resources to the extent they were available under the IRAP.[16]

[15] https://www.justice.gov/file/23226/download
[16] https://www.nnss.gov/docs/docs_FRMAC/FRMACHistoryFinal.pdf

The NRC's responsibilities now focused on licensing and inspecting reactors and no longer had the capacity to do expansive radiation monitoring. The ERDA also agreed to take responsibility for conducting radiological surveys and mapping at all NRC sites. The ERDA developed an internal response plan, which included an Emergency Action Coordinating Team to coordinate any response actions.[17] In the same year, the ERDA became the DOE. All agreements and response capabilities housed at the ERDA were maintained by the newly formed Department of Energy.[18]

Owing to a series of incidents that occurred between 1979 and 1989, existing policies and responsibilities detailing the response to a nuclear or radiological incident were reexamined. This period provided key takeaways in communications, radioactivity measurements, planning, training, and interagency coordination addressing the nuclear and radiological threat.

On March 28, 1979 the Three Mile Island Power Station partial meltdown occurred. The accident started with a minor malfunction affecting the cooling system that lead to a shutdown of the reactor. Although no significant health effects were ever reported as a result of this incident, the accident had a powerful psychological impact and altered the societal perception of nuclear power.[19]

Despite the lack of medical related issues, psychological, social, and communications issues were identified. These issues seemed to come as a surprise to responders and may have only been truly learned in a real-life shutdown of this

[17] FRMAC. The Evolution of the Federal Radiological Monitoring and Assessment Center.
[18] https://www.nnss.gov/docs/docs_FRMAC/FRMACHistoryFinal.pdf
[19] https://www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/three-mile-island-accident.aspx (World Nuclear Association, 2001)

public magnitude. The Three Mile Island incident lead to several lessons learned, including:

1. *The need for continuing improvement in the performance of all nuclear power plants and the training to respond.* In 1980. the NRC Authorization Acts of 1980 directed the NRC to establish emergency preparedness as a criterion for licensing commercial Nuclear Power Plants (NPP). Specifically, the NRC Authorization Acts prohibit the NRC from issuing an operating license for an NPP unless it finds that "there exists a State, local, or utility plan which provides reasonable assurance that public health and safety is not endangered by operation of the facility concerned." The acts also provide for the NRC to consult FEMA in developing standards for evaluating plans/procedures and in making individual determinations that the plans/procedures provide reasonable assurance for protecting public health and safety[20]. The NRC revised its regulations in 10 CFR Part 50 to incorporate additional emergency preparedness requirements, including 16 Planning Standards for onsite and offsite emergency response plans/procedures.[21]

2. The accident provided a better understanding of fuel melting and highlighted how the movies in that time were misleading the public by inaccurately depicting the meltdown breaching the reactor vessel and the containment structure.

3. Public confidence in nuclear energy, particularly in the U.S., declined sharply following the Three Mile Island accident. It was a major cause of the decline in nuclear construction through the 1980s and 1990s (see figure 1)[22]

[20] Pub.L. 96 295, section 109(b), 94 Stat. 80, 784 (1980)

[21] https://fas.org/irp/agency/dhs/fema/rep.pdf

[22] https://sites.utexas.edu/mecc/files/2014/05/Status-of-Nuclear-Reactors-by-Construction-Start-Year.png

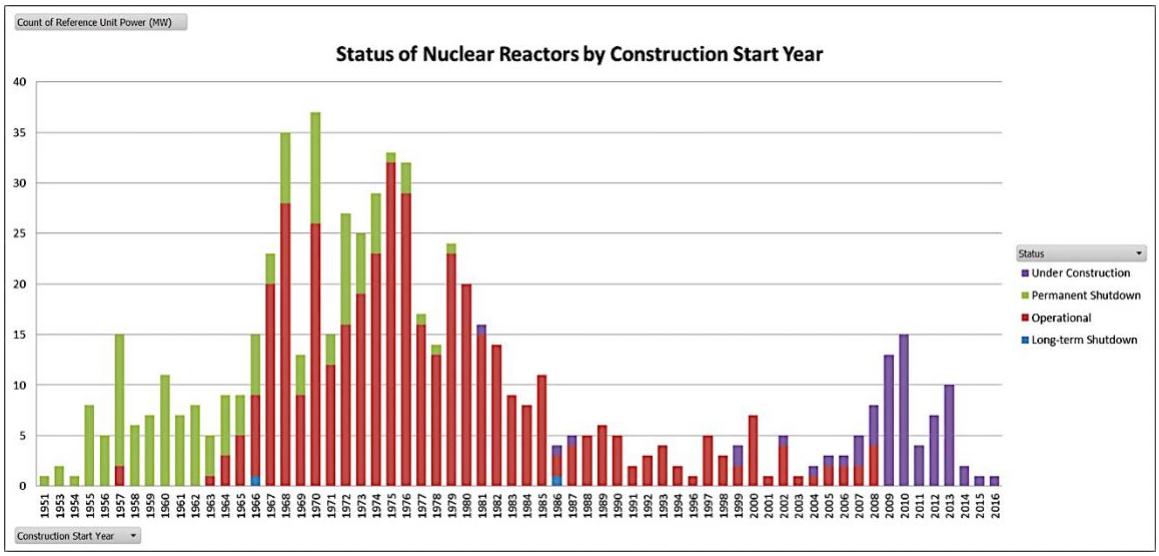

Figure 1 - Decline in Construction in the 80s

Following the Three Mile Island incident, the DOE stood up the Federal Monitoring and Assessment Center (FRMAC). FRMAC is tied to the development of Federal agency planning that followed the Three Mile Island accident. At the time of the accident, the DOE and other agencies had an existing response agreement,[23] but they were not formalized, and specific agencies did not have well defined responsibilities.

FRMAC was formed as a reaction to gaps in response procedures that were exposed by the Three Mile Island incident. Dan Blumenthal, Consequence Management Program Manager in NNSA's Office of Nuclear Incident Response stated that:

> "aerial measurement assets used during the Three Mile Island response would eventually become a part of what is now FRMAC**.** We consider the birth of our office 1985 and was developed to coordinate all federal environmental radiological monitoring efforts."[24]

[23] https://www.nnss.gov/docs/docs_FRMAC/FRMACHistoryFinal.pdf
[24] Blumenthal, Dan, Personal Interview, March 25, 2020

After the Three Mile Island incident, President Jimmy Carter and Congress directed the impacted Federal agencies to develop a plan to provide for an integrated Federal response to radiological emergencies. It was recognized that when a major radiological incident impacts the public, states may need federal assistance to characterize and assess the radiological conditions. This led to the development of the Federal Radiological Emergency Response Plan (FRERP). The FRERP was the guideline used in establishing FRMAC and described the roles of various Federal agencies involved in the response and coordination of Federal activities with the states and responsible agencies. In 2004, this document was superseded by the National Response Plan (NRP). During a domestic nuclear or radiological incident, FRMAC is initially established at the incident location by DOE to provide an operational framework for coordinating and managing all offsite Federal radiological monitoring and assessment activities. Following the emergency phase of an incident, the EPA takes the lead in ensuring appropriate health protection guidelines are followed and recommending further actions.[25]

As a result of the Three Mile Island incident, Executive Order 12148 and the Presidential Directive of December 7, 1979 transferred the lead Federal role in offsite emergency planning and preparedness activities from the NRC to FEMA.[26]

On the FEMA side, the Radiological Emergency Preparedness (REP) Program was stood up. President Carter further established a Presidential Commission, the Kemeny Commission, to conduct a comprehensive study and

[25] https://www.nnss.gov/pages/programs/FRMAC/FRMAC.html
[26] https://www.fema.gov/radiological-emergency-preparedness-program

investigation of the accident. Among its findings, the Kemeny Commission called for the formation of an emergency preparedness framework specific to nuclear power plant incidents. A portion of this responsibility would be allotted to the Federal Emergency Management Agency (FEMA). The Commission made four recommendations that affected FEMA:

> 1.Before a utility is granted an operating license for a new nuclear power plant, the state within which that plant is to be sited must have an emergency response plan reviewed and approved by the Federal Emergency Management Agency (FEMA). The agency should assess the criteria and procedures now used for evaluating state and local government plans and for determining their ability to activate the plans. FEMA must assure adequate provision, where necessary, for multi-state planning.
>
> 2.The responsibility at the federal level for radiological emergency planning, including planning for coping with radiological releases, should rest with FEMA. In this process, FEMA should consult with other agencies, including the Nuclear Regulatory Commission (NRC) and the appropriate health and environmental agencies.
>
> 3.The state must effectively coordinate its planning with the utility and with local officials in the area where the plant is to be located.
>
> 4.States with plants already operating must upgrade their plans to the requirements to be Nuclear Regulatory Commission Authorization, Public Law 96-295, June 30, 1980, Section 304. This authorization requires the President to prepare and publish a "National Contingency Plan" (subsequently renamed the FRERP) to provide for expeditious, efficient, and coordinated action by appropriate Federal agencies to protect the public health and safety in case of accidents at commercial nuclear power plants.

The provisions of Executive Order 12241 of Sept. 29, 1980, directed the publication of a plan to protect the public health and safety in case of accidents at nuclear power facilities and delegated the responsibility to the Director of FEMA.[27]

Chernobyl

[27] National Archives. Executive Order 12241. August 15, 2016

On April 26, 1986, a major meltdown at the Chernobyl Nuclear Power Plant occurred near the city of Pripyat in the northern part of the Ukrainian SSR. The Chernobyl incident is considered by many in the field as one of two nuclear disasters that were graded as a maximum severity incident (the other being the Fukushima Daiichi disaster in Japan) and is regarded as the worst nuclear accident in recorded history.

Alongside radiation-induced deaths and diseases, a World Health Organization (WHO) report labels the mental health impact of Chernobyl as "the largest public health problem created by the accident" and partially attributes this damaging psychological impact to a lack of accurate information. These problems manifest as negative self-assessments of health, belief in a shortened life expectancy, lack of initiative, and dependency on assistance from the state.

On that day in 1986, a sudden surge of power during a reactor systems test destroyed the power plant's Unit 4 nuclear reactor. The accident and the fire that followed released massive amounts of radioactive material into the environment.[28] The reactor flaws and human error are attributed as the initial cause of the incident; complications were compounded by the response. 31 people died within a few weeks of the accident. Soviet authorities started evacuating people from the area around Chernobyl within 36 hours of the accident. Eventually, 115,000 people were evacuated. The Soviet government subsequently resettled another 220,000 people. In addition to initial countermeasures that were deemed inadequate, several lessons were learned as a result of the accident.[29]

- **The need for stringent emergency preparedness plans.** Even with the Chernobyl reactor's poor design, officials could have averted many radioactive exposures to the population with an effective emergency response.
- **The need for timely alerts and notifications.** Chernobyl plant operators concealed the accident from authorities and the local population, and thus the

[28] https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/chernobyl-bg.html
[29] Nuclear Energy Institute. Chernobyl Accident and Its Consequences. May 2019

government did not even begin limited evacuations until about 36 hours after the accident.

- **The necessity of protecting the food chain.** Since authorities did not promptly disclose details of the Chernobyl accident, many people unknowingly consumed contaminated milk and food.[30].

Around this same time, the U.S. government and the interagency began to observe several incidents taking place around the world involving terrorism. The U.S. government and the Reagan administration took notice and drew attention to the threat posed by the use of nuclear and radiological weapons by nonstate actors. Addressing this nonstate threat appeared to become a national security priority. President Ronald Reagan directed the development and adoption of several National Security Decision Directives (NSDD) to include NSDD 30, Managing Terrorist Incidents, NSDD 138, Combatting Terrorism, NSDD 179, Task force on Combatting Terrorism, that was assigned in July 1985 and eventually tasked to the then Vice President George Bush. This task force began a shift to developing a proactive stance on nuclear and radiological threats that would fully develop during the mid 90's. While much of the world took a reactive stance to incidents involving nuclear or radiological material, the U.S. began to place a specific emphasis on conducting exercises and other trainings focused on this issue.

Mighty Derringer

In December 1986, a secret exercise in Indianapolis involving multiple U.S. counterterrorism units from both Federal agencies and the DoD took place. The exercise was based around a scenario involving a nuclear attack by a terrorist group

[30] https://www.nei.org/resources/fact-sheets/chernobyl-accident-and-its-consequences

taking place on U.S. soil. From this exercise, the U.S. and participating agencies were able to identify multiple issues in planning and responding to a terrorist attack involving nuclear material. Additionally, the DOE was able to exercise its Nuclear Emergency Search Team (NEST), a group assigned to respond to plausible nuclear terrorism threats. Currently, NEST (now the Nuclear Emergency Support Team) constantly conducts exercises to 1) assess its capability to respond to a terrorist device involving the use of nuclear material and 2) test its ability to effectively coordinate and integrate with critical Federal and DoD units during a crisis.[31]

A unique aspect of this exercise was that the U.S. was exercising both an international and domestic response to an improvised nuclear device (IND). Pat Daly, who played a critical role in the planning and executing of this exercise, emphasized the importance and lasting impact of this event:

> "It was the first big IND exercise, and it involved the DOE, the DoD, and the State Department. It took place on a portion of the Nevada test site. As part of the exercise, the exercise planners created a notional country which they called Montrev, and they exercised an IND threat in Montrev. The DOS had the lead and coordinated with the DoD's Joint Special Operations Command (JSOC), JSOC is a subcomponent of the U.S. Special Operations Command, and is tasked with operations of the highest sensitivity and national importance. Units that fall under JSOC include the U.S. Army's special missions' unit (often referred to as Delta Force) and the U.S. Navy's Special Warfare Development Group (DEVGRU), popularly known as SEAL Team Six. A second portion of the scenario involved an IND in Indianapolis with FBI working with DoD. I supported the part of the scenario in Montrev and came out with the emergency support team. My role was the ambassador for the state of Montrev assigned to the U.S. embassy. DoD deployed all of their assets to Nevada to test the scenario."[32]

[31] George Washington University, National Security Archive. Mighty Derringer Exercise https://nsarchive2.gwu.edu/nukevault/ebb380/
[32] Daly, Patrick. Interview

The significance of this secret exercise was extremely important for the interagency response to nuclear and radiological planners and coordination. It provided a great deal of follow on actions that would be carried forward into policy and planning. Furthermore, it helped highlight the significance of diplomatic relations during an incident.

But the incident and the difficulties involved in responding to the threat convinced senior leaders that there was a need for a dedicated capability to deal with any attempt at nuclear terrorism. From its inception, NEST devoted considerable time and effort to conducting exercises designed to allow the team to test its readiness, procedures, and equipment in a variety of scenarios. In addition, since confronting a nuclear threat would involve not only NEST but a multitude of organizations, exercises provided an opportunity to identify potential problems in interagency cooperation.[33]

MIGHTY DERRINGER was a particularly notable exercise in exploring the organizational, governmental, and technical problems that might arise in responding to a nuclear terrorist threat. While the existence of MIGHTY DERRINGER has been reported previously, the documents obtained by the National Security Archive and provide far more detail than previously available, including information on the scenario, results, and after-action assessments of the assorted organizations involved. Since NEST and these other government entities are still critical components of America's counter-terrorist capability, these records are valuable for

[33] Jeffrey T. Richelson, *Defusing Armageddon: Inside NEST, America's Secret Nuclear Bomb Squad* (New York: W.W. Norton, 2009), pp. 19-21

the insight they offer into how a current-day nuclear detection operation would unfold and particularly what kinds of problems might be encountered.[34]

The scenario allowed for all aspects of a possible response to a nuclear terrorist threat to be practiced; from initial assessment of the threat to the management of the consequences of a detonation. The documents detailed the core aspects of a response, including intelligence collection, technical and behavioral assessments, search, access/defeat of terrorist forces, recovery of a device, diagnostics, hazards and effects estimation, disablement and damage limitation, safe transportation of the device, and consequence management of a detonation. In addition, they also drew lessons from a variety of important aspects of a response, including security, command and control, communications, logistics, radiological measurement and containment, weather forecasting, public information, and interaction with local officials.[35]

William Chambers, a NEST member and site controller for the Indianapolis component of the exercise, wrote that the coordination and integration that occurred between the FBI's Hostage Rescue Team (HRT) - The FBI's Hostage Rescue Team was formed to address missions of national importance that occur on U.S. soil. It's considered the domestic equivalent of the Army and Navy's special missions units that fall under JSOC, NEST, and Explosive Ordinance Disposal (EOD) personnel was "excellent" but that "the joint procedures for withdrawing the HRT and survivors,

[34] George Washington University, National Security Archive. Mighty Derringer Exercise https://nsarchive2.gwu.edu/nukevault/ebb380/#_ednref3
[35] Ibid

securing the perimeter, and clearing access to the device need clarification."[36] Several other observations from the exercise included great communications, weak senior official involvement, and the gap of not establishing a “public affairs” function. One observer stated it was the most realistic exercise ever conducted by the NEST community.[37]

Goiania

If Chernobyl was the worst incident involving the inadvertent release of nuclear material on a population, the Goiania incident can be considered the worst incident involving the accidental release of radiological material on a population.

In September 1987, an abandoned cesium-137 teletherapy device, used to treat certain cancers, was stolen in Goiania, Brazil. The device’s licensed and regulated entity had left the unit in a vacated building without notifying the proper Brazilian authorities. Two individuals entered the vacated facility and discovered the abandoned teletherapy unit and breached it, removing the portion of the machine containing the radioactive cesium-137 source. These individuals had no idea what the intended use of the material was or that it contained radioactive material; they thought the device could be sold for scrap. They then took the device to their homes and further dismantled it, rupturing the layer of protective material surrounding the radioactive source. Fragments of the cesium-137 within the device, roughly the size of a grain of rice and glowing blue, were distributed to several families in the

[36] Chambers, William. Controller notes from Mighty Derringer Exercise. https://www.documentcloud.org/documents/359519-50-12-19-86-chambers.html
[37] https://nsarchive2.gwu.edu/nukevault/ebb380/#_ednref3

community. After a period of five days, a number of persons were expressing gastrointestinal distress due to their exposure to the radiation from the cesium-137. The symptoms were not initially recognized as a result of exposure to radiation. Eventually, one of the persons irradiated connected the illnesses with the cesium-137 and took samples of the radioactive material to the public health department in the city. This began a chain of events which led to the discovery of the cesium-137 exposure and contamination of the immediate environment and population. Subsequently, the Brazilian government mobilized a major emergency response. Numerous individuals incurred external and internal exposure and the emergency response had to deal with both this and major contamination throughout the city and beyond. In total, some 112,000 persons were monitored, of whom 249 were contaminated owing to the way they had handled the radioactive material.

In the end, 4 died within four weeks, 112,000 patients were monitored, 249 were contaminated either externally or internally, and 85 houses were deemed significantly contaminated. These homes were demolished and over 3,500 m_3 of waste was collected and stored at a specialized facility.[38]

The accident had a major economic impact on the area, depressing trade with other areas of the country and world. Frightened by the prospect of radioactive contamination, neighboring provinces isolated Goiania and boycotted its products. The price of their manufactured goods dropped 40 percent and stayed low for more than a month. Tourism, a primary industry, collapsed and recent population gains

[38] International Atomic Energy Agency. The Radiological Accident in Goiania. 1988

were reversed by business regression. Total economic losses were estimated at hundreds of millions of dollars. A key lesson learned from this incident is the importance of enhancing the broader understanding of radiation.[39]

Key take aways from the incident included:

- Nothing reduces the liability or responsibility of the individual designated for the radioactive source. Sources removed or abandoned present a major hazard.
- An adequate system of information is essential to avert panic on the part of the public.
- An adequate system of social and psychological support should be provided following a radiological accident causing serious contamination.
- The effectiveness of international assistance following a radiological accident depends on the infrastructure of the country concerned.
- For decision making and the organization of working teams following a radiological accident, the hierarchy should be well defined.[40]

The 90s had several significant events that carried us into the millennia.

Although the 90s started to show that we were learning from our mistakes and better preparing for accidents involving nuclear and radioactive material, we still hadn't learned how to conduct a large level response at a national level. Furthermore, terrorism began to become of great concern, posing new problems that hadn't fully been considered with respect to the use of nuclear and radiological material. "Terrorism started becoming more prevalent. The hostage taking in Beirut and Iran, bombings at U.S. embassies in Kenya and Tanzania… weapons of mass destruction (WMDs) started to become important," stated Daly.[41] The U.S.

[39] Nuclear Regulatory Commission, Revisiting Goiania. https://www.nrc.gov/docs/ML1100/ML110030911.pdf. 1993

[40] IAEA. Radiation Sources: Lessons Learned from Goiania. 1998

[41] Daly, Patrick. Interview

government and its response in general had started to shift to a more proactive state, but had been minimal up until this point. Most of the training and exercise prior to the 90s were classified so the first responder didn't even have an understanding of the threat posed by nuclear or radioactive material. There wasn't much training between all levels of government before then.

"In 1980, nations around the world signed the Convention on the Physical Protection of Material in Vienna, Austria," stated former Deputy Chief of Counterterrorism at the Department of Justice, Scott Glick. "We were a signatory, which lead to the enactment of Title 18, starting to put policy and law in place" as he elaborated regarding prosecuting criminals and terrorists for trafficking and using nuclear and radioactive material. "We agreed with nations that this a bad thing. One thing we can see, under section 831 (g), the Attorney General can ask to enact the Posse Comitatus Act when civilian authorities don't' have capability, but no attacks."[42]Essentially, this meant that the Attorney General can authorize the use of DoD personnel on U.S. soil even in the absence of an actual attack.

He further continued that "In the 1990s, terrorist started using WMDs around the world. The 1993 World Trade Center bombing, 1995 was the Oklahoma City bombing, the 1995 Tokyo subway sarin gas attacks by Aum Shinrikyo, in 1996 there were the Khobar Towers bombing in Saudi Arabia, in 1995, President Clinton felt that the 1980 Convention was not adequate. He issued PDD 39 to combat this."[43] Presidential Decision Directive (PDD) 39, which directed U.S. Policy on

[42] Glick, Scott. Personal Interview. March 19, 2020
[43] Ibid

Counterterrorism, was a significant document.[44] "We needed to determine who was the lead Federal agency to deal with the law enforcement aspect. Clinton decided that he was going to organize this. The PDD assigns to FBI as the lead for crisis management and FEMA for consequence management. If we capture a terrorist, everyone is involved to help. To enhance these capabilities, we needed to improve response from lead agency responsibilities and take a whole of government approach."[45]

The signing of the Federal Radiological Emergency Response Plan (FRERP) was also a significant step in aligning U.S. policy with the growing threat. FRERP established an organized and integrated capability for timely, coordinated response by Federal agencies to a peacetime radiological emergency with the objective of outlining public and private sector response and the coordination of Federal agencies.[46]

President Clinton responded with several actions in his PDD. Glick continued:

> "In 1996, Congress passed the Defense against WMDs Act. 9/11 was the change. After Clinton issued PDD 39, the Attorney General established the Attorney Critical Incident Response Group (ACIRG) to provide expert assistance to the Attorney General and U.S. Attorneys' Offices in the event of a crisis[47], Attorney General Janet Reno developed this for attorneys. I was appointed to the team in 1996. We then had to ask, 'how do you organize the cabinet'? You have to issue an NSDD, PDD, on how to organize our resources. This became a change for the Department of Justice (DOJ) lawyers to assist in response. I then was a prosecutor that was added to exercises to prepare to prosecute criminals and terrorists. This is contained in an Inspector General report that goes through its history. ACIRG became critical because of the FBI SWAT teams and the incident at Waco, if lawyers

[44] Clinton Digital Library. PDD-39 - U.S. Policy on Counterterrorism, 6/21/1995
[45] Glick, Scott. Interview
[46] Federation of American Scientists, Federal Radiological Emergency Response Plan (FRERP), May 1, 1996
[47] Office of Inspector General. Review of the Critical Incident Response Plans of the United States Attorneys' Offices. https://oig.justice.gov/reports/EOUSA/e0401/appd.htm. December 2003

> aren't integrated, how do you ask who shot who and killed who? We had to integrate with FBI and DoD."[48]

The question arises, how did the lack of integration between the FBI and DoD impact the exercises and preparedness. Glick's insights on this question are worth citing in full:

> "When Clinton signed PDD 39, It had specific requirements to exercise for the FBI. Clinton was creating an interagency exercise committee within the White House. On the Executive Branch, Clinton was issuing directives. Then congress started allocating money to that direction. The precipices for this was probably with Ruby Ridge, Waco, Oklahoma City…. we need to do this in a better way. There wasn't a lot of exercises going till then. When I was appointed ACIRG, I worked with DoD on joint exercises which I felt was the turning point.
> With respect to terrorism or using WMDs, the big change was a recognition that we were slow to respond. We started seeing that terrorists might be able to do this. The Tokyo gas attack was evidence and we need to try to get ahead of this. It was reactive. In large part, when government tried to spend resources, they at the time were fixing instead of planning ahead. So, in 1996, we need to throw money, which came from the defense against WMDs Act and was a big deal."[49]

The reference Glick made was to Public Law 104-201, section 1411, Response to Threats of Terrorist Use of Weapons of Mass Destruction. From that report, Congress had several findings of significance with respect to nuclear and radiological threats

- Terrorist groups have already conducted a radiological attack in Russia.
- There is a significant and growing threat of attack by WMDs on targets that are not military targets in the usual sense of the term.
- The threat posed to citizens of the US by nuclear and radiological weapons delivered by unconventional means is significant and growing.
- The United States lack adequate planning and countermeasures to address the threat of nuclear and radiological terrorism.
- The Department of Energy has established a Nuclear Emergency Response Team which is available in case of a nuclear or radiological emergency.

[48] Glick, Scott. Interview
[49] Glick, Scott, Interview

- State and local emergency response personnel are not adequately prepared or trained for incidents involving nuclear and radiological materials.
- Exercises of the Federal, State and local response to nuclear and radiological terrorism have revealed serious deficiencies in preparedness and severe problems of coordination.
- Development of, and allocation of responsibilities for, effective countermeasures to nuclear and radiological terrorism in the United States requires well-coordinated participation of many Federal agencies, and careful planning by the Federal Government and State and local governments.
- Training and exercises can significantly improve the preparedness of State and local emergency response personnel for emergencies involving nuclear and radiological weapons or related material.
- Sharing of the expertise and capabilities of the Department of Defense, which traditionally has provided assistance to the Federal, State, and local officials in neutralizing, dismantling, and disposing of explosive ordnance, as well as radiological materials can be a vital contribution to the development and deployment of countermeasures against nuclear weapons of mass destruction.
- The United States lacks effective policy coordination regarding the threat posed by the proliferation of weapons of mass destruction.

Also in the publication, the term “weapon of mass destruction” is defined as *any weapon or device that is intended, or has the capability, to cause death or serious bodily injury to a significant number of people through the release, dissemination, or impact of a) toxic or poisonous chemicals or their precursors; b) a disease organism; or c) radiation or radioactivity.* The term “weapon of mass destruction” and its official definition are of great significance as it had long standing ramifications on how things were prosecuted, but also exercised. This essentially created a framework for identification of which agencies have the lead during an incident, which agencies would be responsible for support, and thresholds for even activity of radioactive material that might be considered.

The report further outlined requirements set forth by Congress on the:

1) assessment of the capabilities of the Federal government to prevent and respond to terrorist incidents involving WMDs and to support state and local prevention and response efforts;

2) requirements for improvements in those capabilities; and

3) the measures that should be taken to achieve such improvements, including additional resources and legislative authorities that would be required.

This report needed to be developed and provided back to Congress no later than January 31, 1997 (296 of Statute 110).[50]

The beginning of a shift from reaction to being proactive

As demonstrated by the history of the U.S. government's policy regarding responding to a nuclear or radioactive incident, the creation of multiple organizations to address this problem, and the ownerships (sometimes overlapping) of different responsibilities and capabilities, the response architecture used by the U.S. government was built predominately on reactive experience from the 1970s until a shift occurred in the late 1990s to 2000. And as the world and the U.S. continued to shift its focus from preparing for nuclear and radiological accidents to incidents in which terrorist or other non-state actors use nuclear or radiological material in an attack, the DOE made one of its greatest changes to deal with both state and non-state actors: the establishment of the National Nuclear Security Administration (NNSA). The NNSA was established by Congress in 2000 as a semi-autonomous agency within the U.S. Department of Energy responsible for enhancing national security through the military application of nuclear science. NNSA maintains and

[50] Public Law 104-201. U.S. Code. https://uscode.house.gov/statviewer.htm?volume=110&page=2717. September 1996

enhances the safety, security, and effectiveness of the U.S. nuclear weapons stockpile without nuclear explosive testing; works to reduce the global danger from weapons of mass destruction; provides the U.S. Navy with safe and effective nuclear propulsion; and responds to nuclear and radiological emergencies in the United States and abroad.[51] Furthermore, NNSA supports the safety and security of non-military applications both domestically and internationally.

Jay Tilden is the current Associate Administrator and Deputy Under Secretary for Counterterrorism and Counterproliferation at the NNSA. The office and entities he oversees are responsible for the NNSA's mission of effectively responding to intentional or accidental incidents involving nuclear or radioactive material, often in coordination with other interagency partners. Speaking to the evolution of U.S. policy regarding nuclear and radiological security measures, he stated that,

> "Generally speaking, if some big radiological or nuclear event took place prior to the 90s, the civil authorities and regulatory base were overwhelmed. The military had been regularly in charge for a radiological environment. The military had the predominance of the capabilities of Chemical Biological Nuclear and Radiological. In the post-Cold War era, a lot of countries atrophied their military component on radiological or nuclear response. In the 90s, we started having the debate of the nuclear energy sector. The capabilities started to shift to the civil side to accident preparedness. It wasn't until the end of the 90s we started to get to the idea of nuclear terrorism.
>
> They were serious attempt at nuclear in 90s. Once Aum Shinrikyo was rounded up after the Tokyo attack, it was apparent that they were trying to get hands on uranium in Australia. Al Qaeda too.[52]

Summary of the Evolution of US Policy

[51] National Nuclear Security Administration. https://www.energy.gov/nnsa/about-nnsa.
[52] Tilden, Jay. Personal Interview. March 26, 2020.

For a summary of the events to 1979 to 2000 and the attendant evolution of U.S. policy towards incidents involving nuclear or radioactive material, the timeline below provides milestones and key events that occurred and some of the reactions and lessons learned. This is not an all-encompassing list and is only provided as a tool to summarize the discussion points and theme in this chapter.

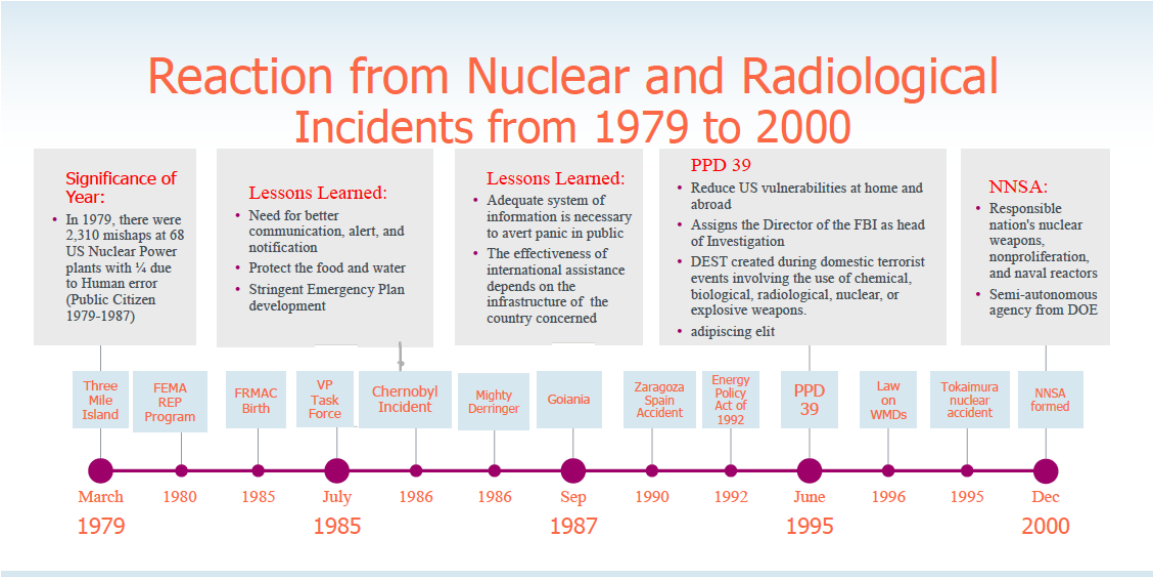

Figure 2

Going Forward

The shift from being reactive to proactive when developing national-level policy is not a simple task, especially when it involves the highly technical and classified problem set of effectively responding to nuclear weapons and radiological material in the hands of terrorists or hostile nations. This chapter focused on the developments in a time period (1970s-2000) being instrumental to the evolution of preparedness. This was a development at the institutional and federal level with both response and policy. This shift was reactive to finally closing the chapter with the evidence on a desire by the Clinton administration wanting to get ahead of the

problem. Insights from key individuals in the field provided context to validate this during an important stage in nuclear and radiological preparedness. It is understandable for many reasons why the U.S. was playing catch for most of the period as each incident provided more understanding and experience of the issues, risk, and need for policy, capabilities, and planning to address future incidents.

In the next chapter, as the world starts to get a handle on preparing for nuclear and radiological incidents, complications arise by the spread of decentralized terrorist organizations, international criminal groups, and pockets of instability throughout the world where regions exist in which no official government authority is recognized. The focus will now shift to the U.S. Government's need for better radiological security measures and response coordination.

Chapter 2.

How has radiological security evolved since the turn of the century?

In this chapter, first-hand experience from the last ten years consulting on, planning, designing, and facilitating a variety radiological preparedness exercises will provide some relevant context on the evolution of radiological security this century. This experience has been gained from running a company that provides consultation on responding to radiological security incidents and coordination and integration of “whole of government” during a radiological security incident. During these ten years, there has been a tremendous change in the security, preparedness, exercises, and coordination to address variety of threats posed by radiological material (during either an accident or deliberate use). The need to be well organized at all levels of government (Federal, state, local, and tribal) is essential to ensure a proper and efficient response so that if radioactive material were stolen or used in a way to harm a population, the U.S. has the ability to rapidly respond to contain, recapture, mitigate, and recover from said incident.

Deliberate radiological security incidents can occur via an attack during the transportation of these materials, at the facility that has the regulatory license to have and use these materials for legitimate purposes, and, in a whole new dimension, can involve new methods, like a cybersecurity attack. Since the security landscape has changed so drastically over the last 20 years, as well as the areas in which countries like the U.S. are vulnerable, the need to plan, prepare, train, and exercise are vital to ensure that all levels of governments function cohesively.

The United States had taken some measures to address radiological security incidents pre-2000, but the structure, coordination and response didn't start to mature until incidents post-2000. Integration and coordination between Federal government agencies and state and local organizations didn't start emerging until the end of the 2000s and hasn't reached a point of maturity until the last ten years. This chapter will focus solely on what has taken place with regards to radiological security from 2000 to the present. As discussed, early on the U.S. government's preparedness policies for nuclear and radiological incidents was reactive in nature and very ad hoc in my last chapter; this chapter will look at the structured Federal response and coordination to radiological security incidents as the evolution of the U.S. government's policy of response and coordination. This chapter will also look back at events from the early 2000s that had the greatest impact on U.S. policy and evolution in U.S. agencies' planning. Furthermore, an exploration of how our country has developed planning guidance, laws, and agency delegation to address the threat of radiological security will be discussed. An argument will be made that the U.S. (and the rest of the world) has been in an infancy stage when it comes to addressing radiological security incidents until the last ten years. This argument will be reinforced by explaining the development of more recent and significant laws, acts, guidance, and conventions, and will include personal interviews conducted with respected subject matter experts in the industry for their perspective and opinion. Due to current events taking place with regards to the Covid-19 pandemic, interviews scheduled with some top officials in the Department of Homeland Security (DHS) and the Federal Emergency Management Agency (FEMA) have had to be

cancelled as they support both radiological security as well as biological security. I will look to reengage these officials following the pandemic to get their perspective and update my research. With respect to the various domestic and international laws, acts, guidance, and conventions, there are literally hundreds of initial and revised versions that have been published in the last 20 years; the intent of this chapter is not to capture and parse the words of every single treaty, memorandum, etc., or to provide a legal or guidance document with a chronological history of every radiological security initiative the world over, but rather paint a picture on how radiological security has evolved structurally (particularly within the U.S.) over the last 20 years. This will include the transition from the pre-2000 “Silo” or “stovepipe” model of agency preparedness to current “whole of government” preparedness structure.

The turn of the century was a turn to terrorism

In the last chapter, the idea was presented that the pivotal shift in U.S. policy involving (nonmilitary) nuclear and radiological incident preparedness didn’t happen until the Clinton administration issued PDD 39, which was in response to multiple terrorist attacks both domestically and internationally. At the start of the 2000s, U.S. agencies and Congress started raising concerns of the threat posed by various weapons of mass destruction (WMDs); radiological threats were of specific concern. This section will provide additional historical relevance to events and how these events impacted the policies and response planning that dictates the U.S.’ radiological security posture.

A significant component of the U.S.' current radiological response policy was the Clinton administration's Presidential Decision Directive-62 (PDD-62), or the "Protection Against Unconventional Threats to the Homeland and Americans Overseas," on May 22, 1998. PDD-62 cemented PDD-39's direction that the Federal Bureau of Investigation (FBI) will serve as the Lead Federal Agency for "crisis management" and the Federal Emergency Management Agency (FEMA) will serve as the Lead Federal Agency for "consequence management" during a radiological or nuclear event. Furthermore, PDD-62 states that it is increasingly likely that terrorist groups, or individuals with criminal intent, may use unconventional methods to disrupt the U.S.' critical infrastructure through the use of WMDs or use WMDs against the U.S. population in an attack. The collective opinion was that criminals and terrorist groups had both the intent and technical capability (which would be proven in the post-2000 world) to use WMDs that included or used radioactive material. This led the U.S. to develop a more efficient, structured, and sophisticated policies and dictated the preparation, coordination, and response to the threat of radiological security incidents. Threats driving policy during this time included terrorist groups choosing asymmetrical attacks on the U.S.' domestic and international vulnerabilities through the use of WMD. Another policy driving threat was intelligence that indicated terrorist groups possessed the knowledge, skills, and abilities to use WMDs.[53]

In January 2001, the U.S. published the Interagency Domestic Terrorism Concept of Operations Plan (CONPLAN), which represented a concerted effort by a

[53] The White House. PDD 62. May 22, 1998. https://fas.org/irp/offdocs/pdd-62.htm

number of Federal departments and agencies to work together to achieve a common goal. The CONPLAN further defined the six primary departments and agencies with responsibilities that were identified in PDD-39. The CONPLAN was designed to provide overall guidance to Federal, state, and local agencies a map of how the Federal government would respond to a potential or actual domestic terrorist threat, particularly one involving WMDs. The CONPLAN outlined, organized, and unified the Federal government's response structure to a terrorist threat or act. In addition, it assigned responsibilities based on capabilities for the timely, coordinated response by Federal agencies to a terrorist threat or act. It also established guidance for assessing and monitoring a developing threat, how to appropriately notify Federal, state, and local agencies of the nature of the threat, and how to deploy critical advisory and technical resources to assist the Lead Federal Agency (LFA) in facilitating interdepartmental coordination of crisis and consequence management activities.[54]

Other details in the CONPLAN included the mission, capabilities, and resources of supporting departments and agencies, and the actions each agency or department must perform during each phase of the U.S.' response to an incident involving the use of WMDs. As a note of clarification, the U.S. government divides an incident into two phases (which have been referenced before): crisis management and consequence management. Crisis management can be thought of as all actions taken to prevent the occurrence of a terrorist attack, and consequence

[54] Federation of American Scientists. https://fas.org/irp/threat/conplan.html. January 2001

management can be thought of as all actions taken to return the government (at all levels) to a proper working state. [55]

The CONPLAN was critical, as it served as the foundation to further develop the plans, policies, and procedures of organizations and agencies at the national, regional, state, and local level. The CONPLAN provided guidelines for communication, response activities, operations, and coordination of public information across all levels of government. It also identified the following agencies as critical to a coordinated response:

- Department of Justice (DOJ) / Federal Bureau of Investigation (FBI) as the lead agency for crisis management
- Federal Emergency Management Agency (FEMA) as the lead agency for Consequence Management
- Department of Defense (DOD)
- Department of Energy (DOE) - providing scientific-technical personnel and equipment in support of the LFA during all aspects of a nuclear/radiological WMD terrorist incident
- Environmental Protection Agency (EPA)
- Department of Health and Human Services (DHHS)[56]

Although this was an excellent step forward in the development of the U.S. government's radiological incident response planning efforts, further refinement of a national response plan and additional developments of the U.S. government's interagency coordination and communication mechanisms would take place over the next 15 years; the result were more fully developed policies.

Prior to the development of the CONPLAN, U.S. intelligence agencies and Congress shared a growing concern over international terrorist groups carrying out a domestic terrorist attack. In a report titled *Countering the changing threat of*

[55] Ibid
[56] Ibid

International Terrorism by the National Commission on Terrorism, it stated, "A terrorist attack involving a biological agent, deadly chemicals, or nuclear or radiological material, even if it succeeds only partially, could profoundly affect the entire nation. The government must do more to prepare for such an event."[57]

The growing concern for Chemical, Biological, Radiological, and Nuclear (CBRN) materials was growing among Federal agencies, in Congress, and in the Bush administration.

In 2001, the International Atomic Energy Association (IAEA), the international organization that promotes the peaceful use of nuclear energy, was also beginning to perceive that radiological material in the hands of terrorists posed a significant threat to the world. The IAEA's Secretariat, as the result of the major findings from a previous IAEA conference, produced a "Revised Action Plan for the Safety and Security of Radiation Sources", also called the Revised Action Plan. The Revised Action Plan was approved by the IAEA's Board of Governors on September 10, 2001. The Revised Action Plan called for Member States, which were countries that have agreed to comply with the radiological security standards and guidance set forth by the IAEA, to implement the IAEA's newly developed *Code of Conduct on the Safety and Security of Radioactive Sources* (which was a non-legally binding legal instrument issued by the IAEA). The effectiveness of this Code of Conduct was later reviewed at a meeting of technical and legal experts in August 2002 with provisions relating to the security of sources needing to be strengthened in light of the events of September 11, 2001. A final version of the Code of Conduct was published in

[57] National Commission on Terrorism. Countering the changing threat of International Terrorism. June 2000.

January 2004.[58] This document, along with several others from the IAEA, serve as international guidance for member states to enhance their security, planning, response, and coordination policies with respect to radiological security.

9/11

On September 11, 2001, a major terrorist attack occurred when nineteen terrorists who were members of al-Qaeda, an Islamist extremist network, hijacked four commercial airplanes. In a coordinated attack, the hijackers intentionally flew two of the planes into the Twin Towers of the World Trade Center, and a third into the Pentagon. Learning about the other hijackings, passengers and crew members on the fourth plane launched a counterattack, spurring the hijacker pilot to crash the plane into a field in Pennsylvania. Nearly 3,000 people were killed on that day, the single largest loss of life resulting from a foreign attack on American soil.[59] For many of those interviewed for this chapter that worked in radiological security during this time, this incident heightened the gravity that the U.S. placed on the terrorist use of WMDs and how to improve security policies, the preparation for terrorist incidents, and the response and coordination during a terrorist incident.

During an interview with the Deputy under Security for the Office of Counterterrorism at NNSA, Jay Tilden, he stated:

> "It wasn't until the 2000s that we started to become more proactive with response to radiological security… we needed to have a broader approach to law enforcement and civil authorities. Radiological expertise started shifting from the DoD to the Federal agencies prior to 9/11, but a gap in experience was starting to be evident in the technical staff at the Federal agencies. NNSA started to partner with DHS, NRC, FEMA and state and

[58] International Atomic Energy Agency. Code of Conduct for the Safety and Security of Radioactive Sources. 2004.
[59] 9/11 Memorial. https://timeline.911memorial.org/#FrontPage.

> local agencies to get ahead of it. 9/11 and the formation of DHS started this by putting train-the-trainer programs into hyperdrive to prepare against a bunch of CBRN threats. Major ports of entry and major targets received money to support critical assets."[60]

The events of 9/11 spurred the review of many U.S. government preparedness policies, including providing the substantial impetus to trigger the revision, creation, and development of new response and coordination policies involving WMD incidents and terrorism.

Lessons Learned

In the years following 9/11, research began to shed light on gaps in the U.S.' Federal coordination and response during a terrorist attack. In the final report from the 9/11 Commission, the executive summary stated that the attack came as a, "shock, and not as a surprise". It stated this because it was found that Al Qaeda had built the infrastructure and capabilities within its organization to sufficiently plan and execute the attack.[61] There were several lessons learned and findings in the report. Some of these findings had direct impact on how the U.S. government would now prepare for radiological security incidents, to include:

- Imagination - Leaders responsible for action and policy didn't believe the threat was possible.
- The most serious weaknesses in agency capabilities were in the domestic arena. The FBI did not have the capability to link the collective knowledge of agents in the field to national priorities. Other domestic agencies deferred to the FBI.
- The U.S. government did not find a way of pooling intelligence and using it to guide the planning and assignment of responsibilities for joint operations involving entities as disparate as the CIA, the FBI, the State Department, the military, and the agencies involved in homeland security.

[60] Tilden, Jay. Personal Interview. March 21, 2020
[61] 9/11 Commission. Final Report. Accessed 4/5/20

- The civilians, firefighters, police officers, emergency medical technicians, and emergency management professionals exhibited steady determination and resolve under horrifying, overwhelming conditions on 9/11.
- Effective decision-making in New York was hampered by problems in command and control and in internal communications.
- Congress and the Executive branch responded slowly to the rise of transnational terrorism as a threat to national security.
- Make homeland security funding contingent on the adoption of an incident command system to strengthen teamwork in a crisis, including a regional approach. Allocate more radio spectrum and improve connectivity for public safety communications and encourage wide-spread adoption of newly developed standards for private-sector emergency preparedness—since the private sector controls 85 percent of the nation's critical infrastructure.

These findings were critical to pushing congress and the Bush administration to further refine agency coordination and communication. This culminated in the development and adoption of the National Incident Management System (NIMS) and the Incident Command System (ICS), both written because of Presidential directives. The 9/11 Commission's report further identified how local and state agencies had not been fully integrated into the national-level coordination and response that was necessary to deal with this attack.

Following 9/11, Al Qaeda and concerns of the terrorist use of WMDs continued. In June of 2002, a significant arrest was made that shifted the radiological security posture in the U.S. In a statement made by the then Attorney General John Ashcroft, he said:

> *"I am pleased to announce today a significant step forward in the War on Terrorism. We have captured a known terrorist who was exploring a plan to build and explode a radiological dispersion device, or "dirty bomb," in the United States. I commend the FBI, the CIA, the Defense Department, and the other Federal agencies whose cooperation made this possible… While in Afghanistan and Pakistan, Al Muhajir [born Jose Padilla] trained with the enemy, including studying how to wire explosive devices and researching radiological dispersion devices. Al Qaeda officials knew that as a citizen of the United States, as a citizen of the United States holding a valid U.S.*

passport, Al Muhajir would be able to travel freely in the U.S. without drawing attention to himself.

The United States government was tracking Abdullah Al Muhajir when, on May the 8th, 2002, this year, he flew from Pakistan into Chicago O'Hare International Airport, where he was placed in the custody of federal law enforcement authorities.

In apprehending Al Muhajir as he sought entry into the United States, we have disrupted an unfolding terrorist plot to attack the United States by exploding a radioactive "dirty bomb."

Now, a radioactive "dirty bomb" involves exploding a conventional bomb that not only kills victims in the immediate vicinity, but also spreads radioactive material that is highly toxic to humans and can cause mass death and injury.[62]

In an interview with Michael Haase, the former Division Director in the International Office of Material Protection and Cooperation at the Department of Energy, additional context was provided and how this incident continued to shift the U.S.' radiological security posture following 9/11. Mr. Haase stated:

> "Radiological Security started to get on the radar with incidents like the Chechen planting of radioactive material in Moscow… terrorists were showing an interest in the material. Prior to Jose Padilla, some security in Russia was done with concern over radiological material. After 9/11, it took off. Jose Padilla was the trigger for Congress funding radiological security. Originally only international incidents were a concern, but this shifted; it went domestic and Padilla showed why it should have been a major concern. Prior to that it hadn't been perceived to be practical or feasible. So, a task force was created in 2003 to break radiological security from nuclear security which involved a big IAEA conference with then DOE Secretary Spencer Abraham."[63]

This was further reiterated by Former Chief with the U.S. Nuclear Command and Control Systems, Jay Carroll. He provided his perspective from working within DoD at the time:

> "Predominately, up to this point, radiological security had been viewed in a military context. 9/11 was the point we began to fully engage on all the sources, to include radioactive. For the military, it was the security of nuclear weapons. The big change was reevaluating risk and what that risk tolerance

[62] Department of Justice. Al Qaeda "Dirty Bomb" Plot Disrupted. June 2, 2002.
[63] Haase, Michael. Personal Interview. April 3, 2020.

> was. The radiological source issue wasn't new. The NRC, DOE, and IAEA started to develop guidelines to protect and secure radioactive material out there. There are numerous sources that were out there around the world in abandoned hospitals or facilities. All of sudden we thought, what if a terrorist group made a dirty bomb? This began the discussion in the military and interagency (a group of Federal agencies with responsibilities to secure and respond to radiological incidents). We went to a run after 9/11. We were "high and to the right" for these threats. We quickly realized the problem was a lot bigger than us. We had to prioritize risks and threats. We had an intel community trying to figure issues of theft. It [radiological risk] was a safety-based threat prior to that. Operationally, we began to ask how do we handle this? DoD's Defense Threat Reduction Agency (DTRA) looked to help Russia at first to protect material, and then all over the map. The other thing we started doing was working in various groups doing good work, but they were in silos. DOE and DTRA was also doing good work in the same area but not integrated."[64]

So, although the U.S. saw the need to address radiological security, the infrastructure necessary to support effective cooperation and coordination had not been developed. This can be understandable to people in radiological preparedness, as it does follow some theories on risk assessment. In those theories, organizations identify the most significant risks arising from an on-going basis and:

- Prioritize risks based on the likelihood of occurrence and potential impact.
- Implement strategies to mitigate risks
- And monitor effectiveness of risk management efforts[65].

Since there was not prior public evidence of radioactive material being a concern, it demonstrates why radiological security was relatively new.

Among other responses by the U.S., on October 24, 2001, the House passed the USA Patriot Act of 2001 which went into law. Of the many sections included in

[64] Carroll, Jay. Personal Interview. April 1, 2020.
[65] Georgetown University. Risk Management Overview. Accessed April 11, 2020

this act that focused on stopping terrorism, several sections included aspects to reduce terrorist access to and use of weapons, including radiological materials.

> (Sec. 411) Includes within the definition of "terrorist activity" the use of any weapon or dangerous device.
>
> Redefines "engage in terrorist activity" to mean, in an individual capacity or as a member of an organization, to: (1) commit or to incite to commit, under circumstances indicating an intention to cause death or serious bodily injury, a terrorist activity; (2) prepare or plan a terrorist activity; (3) gather information on potential targets for terrorist activity; (4) solicit funds or other things of value for a terrorist activity or a terrorist organization (with an exception for lack of knowledge); (5) solicit any individual to engage in prohibited conduct or for terrorist organization membership (with an exception for lack of knowledge); or (6) commit an act that the actor knows, or reasonably should know, affords material support, including a safe house, transportation, communications, funds, transfer of funds or other material financial benefit, false documentation or identification, weapons (including chemical, biological, or radiological weapons), explosives, or training for the commission of a terrorist activity; to any individual who the actor knows or reasonably should know has committed or plans to commit a terrorist activity; or to a terrorist organization (with an exception for lack of knowledge).[66]

The passing of the patriot act provided the government additional means to prevent and protect the U.S. through several portions of the Act which allowed Investigators to use the tools that were already available to investigate organized crime and drug trafficking. Allows law enforcement to use surveillance against more crimes of terror including allowing -

- Federal agents to follow sophisticated terrorists trained to evade detection.
- Law Enforcement to conduct investigations without tipping off terrorists.
- Federal agents to ask a court for an order to obtain business records in national security terrorism cases.[67]

[66] https://www.congress.gov/bill/107th-congress/house-bill/03162
[67] Department of Justice. “US Patriot Act of 2001” https://www.justice.gov/archive/ll/highlights.htm

The Patriot Act also facilitated information sharing and cooperation among government agencies so that they can better "connect the dots." The Act removed the major legal barriers that prevented the law enforcement, intelligence, and national defense communities from talking and coordinating their work to protect the American people and our national security.[68]

Further, the Patriot Act updated the law to reflect new technologies and new threats**.** The Act brought the law up to date with current technology, so we no longer have to fight a digital-age battle with antique weapons-legal authorities leftover from the era of rotary telephones. Allows law enforcement officials to obtain a search warrant anywhere a terrorist-related activity occurred.

Finally, the Patriot Act increased the penalties for those who commit terrorist crimes. Americans are threatened as much by the terrorist who pays for a bomb as by the one who pushes the button. That's why the Patriot Act imposed tough new penalties on those who commit and support terrorist operations, both at home and abroad. In particular, the Act:

- Prohibits the harboring of terrorists. The Act created a new offense that prohibits knowingly harboring persons who have committed or are about to commit a variety of terrorist offenses, such as: destruction of aircraft; use of nuclear, chemical, or biological weapons; use of weapons of mass destruction; bombing of government property; sabotage of nuclear facilities; and aircraft piracy.

[68] Ibid

- Enhanced the inadequate maximum penalties for various crimes likely to be committed by terrorists: including arson, destruction of energy facilities, material support to terrorists and terrorist organizations, and destruction of national-defense materials.
- Enhanced a number of conspiracy penalties, including for arson, killings in federal facilities, attacking communications systems, material support to terrorists, sabotage of nuclear facilities, and interference with flight crew members. Under previous law, many terrorism statutes did not specifically prohibit engaging in conspiracies to commit the underlying offenses. In such cases, the government could only bring prosecutions under the general federal conspiracy provision, which carries a maximum penalty of only five years in prison.
- Punishes terrorist attacks on mass transit systems.
- Eliminates the statutes of limitations for certain terrorism crimes and lengthens them for other terrorist crimes.[69]

Homeland Security

In November 2002, the Department of Homeland Security (DHS) was established under the Homeland Security Act. Under this act, the primary mission was to prevent terrorist attacks and reduce the vulnerability of terrorism in the United States. Additionally, the act delegated DHS would have responsibility to coordinate with state and local government personnel, agencies, and authorities, and with the private sector, to ensure adequate planning, equipment, training, and exercise

[69] Ibid

activities. Also, DHS was responsible for coordinating and, as appropriate, consolidating, the Federal government's communications and systems of communications relating to homeland security incidents with state and local government personnel, agencies, and authorities, the private sector, other entities, and the public; and distributing or, as appropriate, coordinating the distribution of warnings and information to state and local government personnel, agencies, and authorities and to the public.[70] The creation of DHS led to many changes in the government including shifting several agencies under DHS' authority, including the Coast Guard, FEMA, the Transportation Security Administration, U.S. Immigration and Customs Enforcement, and others. This was a significant shift in coordination efforts as the U.S. started to realize that there was a greater need for internal cooperation of agencies and acted on that realization.

Background Guidance and Presidential Directives that Improved Coordination in the U.S.

The Homeland Security Act was followed by action from the Bush Administration issuing Homeland Security Presidential Directive (HSPD)-5. The purpose of this directive was to enhance the ability of the United States to manage domestic incidents by establishing a single, comprehensive national incident management system. It further detailed that to prevent, prepare for, respond to, and recover from terrorist attacks, major disasters, and other emergencies, the United States Government shall establish a single, comprehensive approach to domestic incident management. Furthermore, with regard to domestic incidents, the United

[70] Public Law 107-296. Homeland Security Act. November 25, 2002

States Government were to treat crisis management and consequence management as a single, integrated function, rather than as two separate functions and identified the Secretary of Homeland Security as is the principal Federal official for domestic incident management as delegated in the Homeland Security Act of 2002.[71] In a study conducted by Richard Falkenrath for the Brooking's Institute, he summarized this reorganization by stating that:

> The U.S. government has initiated major changes in its incident management system in the three years since the 9/11 attacks. This new system is, in many respects, a work in progress. Many of the changes currently underway are not well understood outside the government or even, in some cases, within the government.[72]

HSPD-5 may not have produced all of the desired results with regards to coordination of agencies, but it was the major step needed for outlining the structure with regards to managing incidents. The Former Chief of CBRN Operations at the Department of Homeland Security and Chief of National Policy and Planning at the FBI, Victor Valentine Davis, provided additional insight:

> "After 9/11 and Amerithrax [the name given to the investigation of the 2001 Anthrax attacks], CBRN was something to look at closely. There started to be a more proactive shift made to radiological incidents. What are we doing for security and how are we going to respond? It is going to have to include state and locals. The "Whole of Government" response wasn't really started until HSPD-5. We always looked at crisis and consequence differently because historically they were handled separately. The Attorney General was responsible for Law Enforcement (LE) response and the FEMA administrator for consequence. That bifurcation caused problems because they weren't talking. It was a gap that could be exploited. We needed to ensure crisis and consequence response was treated as a single integrated function. The Secretary of Homeland Security would be the one to ensure all the pieces are working together and that crisis and consequence was one unit. HSPD-5 led to the enacting of National Incident Management System.

[71] The White House. Homeland Security Presidential Directive 5. February 28, 2003.
[72] Falkenrath, Richard/The Brookings Institute. Homeland Security and Consequence Management. June 1, 2005.

> We needed to have one national system where everyone talks together. They all have to speak the same language. Interoperable communications. Adding certifications under Incident Command System to qualify individuals on competency."[73]

As stated before, HSPD-5 may not have fixed everything, but it did transform coordination and communication among all levels of government. On March 1, 2004, after close collaboration with state and local government officials and representatives from a wide range of public safety organizations, Homeland Security issued NIMS. It incorporated many existing best practices into a comprehensive national approach to domestic incident management, applicable at all jurisdictional levels and across all functional disciplines.

The NIMS represented a core set of doctrine, principles, terminology, and organizational processes to enable effective, efficient and collaborative incident management at all levels of government (Federal, state, and local). To provide the framework for interoperability and compatibility, the NIMS is based on a balance between flexibility and standardization. The recommendations of from a dedicated commission assigned to investigate the attacks, further highlighted the importance of the Incident Command System (ICS). The Commission's report recommended the national adoption of the ICS to enhance command, control and communications capabilities.[74]

NIMS provided a common, nationwide approach to enable the "whole community" to work together to manage all threats and hazards. NIMS applied to all incidents, regardless of cause, size, location, or complexity. ICS was designed to

[73] Valentine Davis, Victor. Personal Interview. April 3, 2020
[74] FEMA. NIMS and the Incident Command System. 2017

enable effective and efficient domestic incident management by integrating a combination of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure.[75]

NIMS and ICS were significant policy documents for the U.S., but they still did not fully address the complexities of an effective response and coordination to a radiological security incident. Addressing this issue, Pamela Piersanti, former Supervisory Special Agent and Unit Chief for FBI's WMD Directorate, provided her perspective of the shifts and changes during this time:

> "Most of the strategic work started with nuclear, then cascaded to radiological which we ran into in 2003. We were heavily involved into "silos of excellence" [meaning we had great agencies working on issues individually, but not across the interagency]. As we looked at roles and responsibilities… whether you were DoD, FEMA, or the FBI, we didn't crosscut. There was a belief that each entity had their capability and they would be successful. You accepted the word of the other on game day without rehearsal.
>
> We shifted from that. There were policies that started to be drafted such as Bush's HSPD -5, as it talked to integration. That named the Secretary of Homeland Security as the coordinating role of the response actions. It was the first step in recognizing the problem. It didn't implement anything. It was for the departments and agencies to figure it out. There wasn't a push to implement. It was disjointed and didn't tie to policy. It didn't reach down to state and local. It named them but didn't include them in execution. HSPD-5 set the stage for a lot of things, including conflict at DHS Secretary level and at Attorney General level. It didn't set a good foundation at the state and local level. It was a good document because it was unclassified. Typically, something like this gets classified; HSPD-5 was left unclassified so it could be socialized."[76]

What Ms. Piersanti concluded was this was still a new area for the U.S. and coordination hadn't fully been integrated at all levels of government, regardless of any directives issued.

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[75] Ibid

[76] Piersanti, Pamela. Personal Interview. April 1, 2020.

These shortcomings and gaps would be addressed by subsequent policies. Following HSPD-5, two other significant and unclassified documents helped pave the way towards better coordination: The Bush administration issuing HSPD-8, and the Obama administration issuing Presidential Policy Directives. Mr. Valentine-Davis provided context on the significance of these two directives.

> "This [HSPD-5] was followed by HSPD - 8 and provided national planning scenarios. The National Preparedness Guidelines' fifteen National Planning Scenarios depict specific high-consequence threats, both natural and manmade, around which Federal planning efforts are focused. These scenarios identify particular threats that could result in potentially catastrophic effects on our nation and that would require particularly robust coordination across all levels of government, nongovernmental organizations, private sector entities and our international partners. For those reasons, these scenarios form the basis for national planning, training, investment and exercises.[77] An amendment was made under HSPD – 8, coordinated by the Secretary of Homeland Security and putting in motion the development of the National Response Framework (NRF). This document was originally named the National Response Plan, it was developed in 2004, revised in 2006, and eventually became the NRF in 2008). The annexes of the NRF related to incidents and preparedness activities included exercises and training. These exercises and training had to be coordinated. How does this all fit and go together. Coordinating communications, activities, and leadership."[78]

HSPD-8 also did two major things. First, it identified steps for improved coordination in response to incidents. This directive described the way Federal departments and agencies will prepare for such a response, including prevention activities during the early stages of a terrorism incident.[79] Secondly, it put into motion the most critical guidance for all levels of government to date concerning planning and coordination. This would all be made clear in the NRF that is later

[77] FEMA. National Response Framework. January 2008.
[78] Valentine Davis, Victor. Interview
[79] The White House. Homeland Security Presidential Policy Directive 8. Accessed April 4, 2020.

discussed. HSPD-8 specifically highlighted the need to develop a national preparedness goal with:

- The Secretary of the Department of Homeland Security as the principal Federal official for coordinating the implementation of all-hazards preparedness in the United States. In cooperation with other Federal departments and agencies, the Secretary coordinates the preparedness of Federal response assets, and the support for, and assessment of, the preparedness of State and local first responders.

- To help ensure the preparedness of the Nation to prevent, respond to, and recover from threatened and actual domestic terrorist attacks, major disasters, and other emergencies, the DHS Secretary, in coordination with the heads of other appropriate Federal departments and agencies and in consultation with State and local governments, shall develop a national domestic all-hazards preparedness goal. Federal departments and agencies will work to achieve this goal by:
  (a) providing for effective, efficient, and timely delivery of Federal preparedness assistance to State and local governments; and

  (b) supporting efforts to ensure first responders are prepared to respond to major events, especially prevention of and response to threatened terrorist attacks.

- The national preparedness goal will establish measurable readiness priorities and targets that appropriately balance the potential threat and magnitude of terrorist attacks, major disasters, and other emergencies with the resources required to prevent, respond to, and recover from them. It will also include readiness metrics and elements that support the national preparedness goal including standards for preparedness assessments and strategies, and a system for assessing the Nation's overall preparedness to respond to major events, especially those involving acts of terrorism.[80]

This was a big step for our government to move our country's response to a more proactive state and develop a goal or "end state". From a security perspective, this directive put into words what hadn't yet been defined.

[80] The White House. Homeland Security Presidential Directive – 8. December 17, 2003.

Cumulatively, the Homeland Security Act, HSPD-5, and HSPD-8, put the U.S. government and the interagency on the path towards the development of the NRF and the additional coordination that it stipulated. During this time several iterations of a national plan were developed, included the Federal Response Plan and National Response Plan, but were abandoned as the NRF would supersede them and act as the U.S. framework for incident response, including radiological security incidents. The NRF remains the current policy guiding the federal government's response to a large-scale incident.

The National Response Framework (NRF)

In January 2008, FEMA released the National Response Framework (NRF) as a guide on how the U.S. government and the interagency conducts all-hazards response. As illustrated earlier, previous directives or plans lacked a "whole of Government" response and typically addressed threats individually. Prior to the NRF, the U.S. set guidance for preparing for specific scenarios which then shifted under the NRF to "preparing for all-hazards" so agencies could cross-cut preparedness activities. The NRF is built upon scalable, flexible, and adaptable coordinating structures to align key roles and responsibilities across the nation, linking all levels of government, nongovernmental organizations, and the private sector. It is intended to capture specific authorities and best practices for managing incidents that range from the serious but purely local, to large-scale terrorist attacks or catastrophic natural disasters.

The core document, along with the Emergency Support Function Annexes and Support Annexes, supersedes the corresponding sections of the National

Response Plan (2004, with 2006 revisions) and been developed prior to the FEMA release. The Incident Annexes remained in effect until superseded by new guidance, several having been updated as recently as 2016.[81]

The NRF provided the U.S. with many guides that are still in use for response coordination and further addresses radiological security. The NRF also provided more detailed information to assist practitioners in implementing the Framework:

- Emergency Support Function Annexes grouped Federal resources and capabilities into functional areas that are most frequently needed in a national response (e.g., Transportation, Firefighting, Mass Care).
- Support Annexes described essential supporting aspects that are common to all incidents (e.g., Financial Management, Volunteer and Donations Management, Private-Sector Coordination).
- Incident Annexes addressed the unique aspects of how we respond to seven broad incident categories (e.g., Biological, Nuclear/Radiological, Cyber, Mass Evacuation).
- Partner Guides provided ready references describing key roles and actions for local, tribal, State, Federal, and private-sector response partners.[82]

The NRF provided the structure that ultimately tied together the NIMS, ICS, and guidance that would organize the overall coordination at all levels of government during an incident. This was set in motion in 2008, but it was still missing the National preparedness goal that wouldn't ultimately be adopted until Presidential Policy Directive-8 was implemented under the Obama Administration. To provide context, the following summary from the Congressional Research Services Report for Congress highlights the importance of this document:

> Presidential Policy Directive 8: National Preparedness (PPD-8) was signed and released by President Barack Obama on March 30, 2011. PPD-8 and its component policies intend to guide how the nation, from the Federal level to private citizens, can "prevent, protect against, mitigate the effects of, respond

[81] FEMA. National Response Framework. January 2008.
[82] Ibid

to, and recover from those threats that pose the greatest risk to the security of the Nation." These threats include terrorist acts, natural disasters, and other man-made incidents. PPD-8 evolves from, and supersedes, Homeland Security Presidential Directive 8, which was released under President George W. Bush. PPD-8 is intended to meet many requirements of Subtitle C of the Post-Katrina Emergency Reform Act of 2006

In addition to the main Directive, an Implementation Plan for PPD-8 and a National Preparedness Goal were finalized in 2011. Two National Planning Frameworks are also complete, but multiple component PPD-8 policy documents are still being developed. Some elements of PPD-8 may not be finalized until September 2012 or later. However, PPD-8 has already affected national preparedness policy by expanding the scope of the end-state objective for preparedness, modifying the capabilities-based planning methodology, identifying a new set of national capabilities, and directing the creation of more National Planning Frameworks. It is anticipated that the five National Planning Frameworks—one each for prevention, protection, mitigation, response, and recovery—will assign federal roles and responsibilities in each mission area. The National Planning Frameworks are also to guide how nonfederal resources are leveraged, including non-profit and private sectors' resources.

With Regards to PPD-8, the White House also provided this statement:

As part of the implementation of Presidential Policy Directive 8 (PPD-8), we are pleased to announce the release of the first-ever National Preparedness Goal. To summarize, the goal is:

To have a secure and resilient Nation with the capabilities required across the whole community to prevent, protect against, mitigate, respond to, and recover from the threats and hazards that pose the greatest risk.

The Goal identifies the core capabilities and capability targets necessary to advance our national preparedness. It builds extensively on the prior work of many stakeholder groups from around the nation, draws upon lessons learned from large-scale and catastrophic events, and represents input from all stakeholders.

It also recognizes what many of you have known for some time – as we work to build a more prepared nation, we cannot only look at the role that government plays, we must also work with the entire community – both the public and private sectors, faith-based and non-profit organizations, and most importantly the public.

Now that the National Preparedness Goal is complete, we will continue our work on the additional requirements of PPD-8:

- *A National Preparedness System Description;*
- *A series of National Frameworks and Federal Interagency Operational Plans'*
- *A National Preparedness Report; and*
- *A Campaign to Build and Sustain Preparedness* [83]

How PPD-8 impacted those at the practitioner or operational level, Mr. Valentine Davis commented:

> "Under PPD-8, National response framework got broken up into five frameworks – Prevention, Protection, Response, Mitigation, and Recovery. Basically, this led to the Federal Interagency Operational Plans (FIOPs). This essentially said, let's talk as a Federal government with regard to what we are doing as activities. This complicated things because it was separated the five separate plans. When does one plan end and the other one start? It has a lot to do with funding and scope. So, from a radiological security perspective, we entered a heightened alert around the time Obama got elected. I was in DHS at the time. What if there was really a threat, what would you really need? So, there in 2008-2009, a lot of agencies were protecting their lanes and budgets.
>
> In 2009-2010, the Federal agencies really started syncing and working on how are we actually going to coordinate a response? We did 3 or 4 exercises in crisis action teams, Joint Nuclear Response Team (NRT). It was the same people doing the all of the exercises… not much training for a larger audience and state and locals. Interagency Incident Management Group (IIMG). All National Guard, FBI, CIA, NSA, DHS, CBP, Coast Guard, DIA, DOE, NNSA to practice radiological security on if something happens… this was held at the National Operations Center. How many times do you have a terrorist incident like 9/11? This never actually gets used. FEMA, NRC was important to DHS then focusing on man-mand crisis response at the national level. This eventually got disbanded and left a big gap."[84]

Mr. Valentine Davis discussed how important the interagency was to help improve the cooperation and coordination among the principal agencies. With

[83] The White House. PPD-8: Announcing the National Preparedness Goal. October 7, 2011

[84] Valentine Davis, Victor. Interview.

regards to radiological security, Interagency groups meeting to address the response and coordination was a big development. He contended that the IIMG left a big gap, but that the interagency eventually revitalized its efforts and started multiple other cooperative mechanisms in the last 10 years that are still currently used.

During the period between 2000 and 2010, an explosion of policies, plans, and guidance had been developed, updated, and implemented to support the coordination of a response and delegate roles during a national level incident. These policies also had a tremendous impact in how the U.S would respond to a radiological security incident. Numerous other relevant documents not mentioned in this chapter include national strategies, guidance documents such as FEMA's *Managing the Emergency Consequences of Terrorist Incidents*, operational plans and countless others along with their revised versions to support a better radiological security culture and coordination in the U.S.

Agencies Supporting Radiological Security

In order to better explain the complexities inherent in an effective radiological response, it is necessary to provide information on the predominate agencies involved with radiological security and incidents. As stated before, the prioritization of responding to a radiological incident, be it accidental or intentional, has changed throughout the years. The Jose Padilla case made an attack using radiological material a real world, rather than conceptual, threat. From a 2003 article published in the National Institutes of Health:

A radiological terrorist attack on the United States is a possibility. This could involve the dispersal of radioactive material by an attack on a nuclear facility, deployment of a radiation dispersal device, or, less likely, detonation of a nuclear weapon. To decrease our vulnerability to this type of threat, the medical community should have a basic understanding of radiation hazards and their medical management, and it should be prepared to interact with appropriate federal agencies to facilitate the employment of emergency response plans.[85]

The changing perception of how a radiological attack would impact a major city is illustrated by the following quote from the Deputy Commissioner of the New York Police Department:

"What would have been the impact if the improvised explosive devices detonated at the finish line of the Boston Marathon on April 15, 2013 would have contained radiological material? The fallout from a radiological dirty bomb event could demand a much larger recovery than a conventional strike. An attack in a dense urban area such as Boston or New York City would cause contamination to a large area around the site of the explosion. The impacted area would have to be evacuated… while environmental remediation is carried out. There could also be deep psychological scarring from the event. There would be mass panic…a potential death knell for a major urban area."[86]

From the 2017 *National Strategy for Countering Weapons of Mass Destruction:*

Domestically, we must empower our frontline defenders—our state and local law enforcement professionals—as well as many other government, civil society, and private sector partners to prevent and counter terrorism in the United States."
"We will bolster efforts to detect nuclear, chemical, radiological, and biological agents and keep them from being used against us. We will also better integrate intelligence, law enforcement, and emergency management operations to ensure that frontline defenders have the right information and capabilities to respond to WMD threats from state and non-state actors."

"For materials that remain necessary for commercial, medical, or research purposes, we will assist in improving our partners' capacity to guard against both external and insider threats—in storage, in use, and in transit."[87]

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[85] National Institutes of Health. Radiological Terrorism. https://www.ncbi.nlm.nih.gov/pubmed/12854429. June 2003

[86] Nuclear Threat Institute. https://www.nti.org/gsn/article/us-officials-warn-dirty-bomb-danger-aftermath-boston-bombing/. April 25, 2013.

[87] The White House. National Strategy for Countering Weapons of Mass Destruction. December 1, 2018.

These are just a handful of the sentiments that show both the increased concern that radioactive material could be used in a terrorist attack and the growing prioritization to prepare for this kind of incident. There are three agencies that have a significant role in securing and protecting radioactive material, and if necessary, responding to a deliberate or accidental radiological incident.

NNSA, FBI, and DHS

The first of the three agencies to be discussed is the National Nuclear Security Administration (NNSA), which is a semi-autonomous organization within the U.S. Department of Energy responsible for a wide range of missions within the nuclear and radiological world. Within the NNSA, multiple sub-offices and departments exist each with specific goals and missions as it relates to nuclear and radiological issues. One such department is the Office of Radiological Security (ORS), formerly known as the Global Threat Reduction Initiative (GTRI)

ORS (then GTRI) had been tasked with the "protection" mission by NNSA, making it a leading agency ensuring high-activity radioactive materials were kept out of the hands of terrorists or other non-regulatory actors. The protect mission was one of the key concerns raised by Congress and multiple Presidential administrations. Former Director of North and South America with GTRI, Ioanna Iliopulis, provided her recollections of the start of the GTRI program:

> **"**The whole conversation of radiological source security started in 2000. There were discussions on non-voluntary programs for radioactive sources. It started with the IAEA's *Code of Conduct.* In the 90s, safety was the concern. Radioactive sources weren't looked at as being maliciously used for an economic or psychological tool by terrorists. That was born after 9/11 and beyond. GTRI didn't get funded for these programs to start. We started looking at radioactive materials after the Jose Padilla arrest. Congress started getting more concerned.

They were concerned for all classes of WMDs. At the time, the U.S. government wasn't organized to address radiological terrorism. It was little bit focused to radiological threats, but mainly in small pieces or under nuclear. In 2003-2004, NNSA's percentage of total funding was .2% that was dedicated for radiological security. This was considered a lower consequence incident. The focus was really to give us more money to start these programs. It started with Russian support and international programs. Domestic programs didn't start in 2008-2009. So, we went back to countries with nuclear material and looked at if they had radiological material. The DOE National Labs were less interested at the time. Those in the field looked at supporting radiological security as a step down from supporting nuclear security. Now we put a security lens on something we originally looked at as a material safety issue.[88]

Again, this makes sense why security for radioactive material hadn't been addressed until the arrest of Jose Padilla and 9/11. Providing additional background on the early days of GTRI was Joe Schwartzel, a former Navy SEAL and current response consultant to ORS:

"I started in 2002 working with NNSA. At the time, there wasn't much domestic work. It was the Materials, Controls, Protections, and Accounting (MCPA) program, and we were working with former Russian states. All Nuclear. After 9/11, Congress wanted to know about radioactive material, and Radiological Dispersal Devices (RDDs). At the start, it was all physical protection. First economic impact studies were done in '04 or '05 by Sandia National Lab and was classified at first. They did a city simulation with 2000 curies of cesium-137, detonated an RDD in downtown Manhattan, used explosions as tests in the simulation… how far does it spread and what was the economic impact, using the existing Protective Action Guidelines by EPA and how does that affect people and business? We used this for arguing for budgets and installing physical security. This was then used as information with congress for budget. In 2008, we started a domestic process. There were Senate and House questions, why aren't we doing this here in the US, but were doing it overseas? There were NRC guidelines in 2005 came out with "Increased controls". They started with the biggest first, nuclear reactors, then used IAEA 16 isotopes of concern. The Code of Conduct provided other guidance on radioactive material. Pacific Northwest National Labs and Sandia National Laboratories started supporting sites across the country. In 2008, we got involved with the WMD counterterrorism exercise program to help secure U.S. sites with radiological sources and material."[89]

[88] Iliopulis, Ioanna. Personal Interview. April 2, 2020.
[89] Schwartzel, Joseph. Personal Interview. April 2, 2020

ORS has supported radiological security measures for over 18 years. ORS prioritizes its activities by focusing on three pillars: Protect, Remove, and Reduce. The Protect Pillar involves protecting sites with high-activity radioactive material by hardening rooms that house material (enhanced access controls to areas with radioactive material, installing state of the art security and surveillance systems in these areas, upgrading the physical shielding around the machines that have radioactive material inside them, and other steps), conducting training and exercises at all levels of government (these training range from the tactical to the policy level), and ensuring that sites, agencies, and cities have in place effective response policies. On the Remove Pillar, they assist organizations and governments with the safe and organized removal of unused or unnecessary radioactive material across the world. Lastly, on the Reduce Pillar, they assist participating organizations with the transition to from radioactive materials to alternate non-isotopic (material that does not have the same health effects as radioactive material) technology (when feasible) in an effort to eliminate the threat entirely.[90]

To support ORS, NNSA employs contractors (non-Federal employees with expertise in specialized areas who work for private companies that are contracted to provide services to the government) as well as the Department of Energy's National Labs (the labs, which are geographically dispersed across the U.S., were born out of the early efforts to build the atomic bomb during World War II and have since evolved to support a variety of missions within NNSA's portfolio). Matt Thompson,

[90] Office of Radiological Security. https://www.energy.gov/nnsa/office-radiological-security-ors. Accessed 04/10/20.

who leads a variety of initiatives under the Protect Pillar, belongs to the latter group, and has supported ORS for over 10 years through Sandia National Labs (SNL), located in Albuquerque, New Mexico:

> "I came into response integration partly in support to the National Labs being involved. They come at it in a scientific facet such as new sensors, platforms, etc. DOE had the National Labs take the lead on radiological security. Now… these are science and technology labs. You can't always deal or handle a security problem through technology. The way it truly needs to be handled is with detection, delay, and response… three pillars of a physical protections system, or PPS.
>
> SNL was providing cameras, widgets, fiber optics… they can apply science to that aspect. For delay, we slow the advisory down to allow a law enforcement response to arrive at a site. How long will it take bad guys to cut through a fence and leave? Lots of opportunity for science and technology. For response, it is a human problem, huge physical and psychological problem. How fast can we get to this problem with the focus on getting to the situation with a fight? We don't teach them how to shoot, we try to throw science and tech at the response problem. That had been a problem for over the last 15 years. Another piece of this problem is that you can't establish probabilities of human performance. When I was brought in, I was supporting physical security with DOE's Office of Secure Transportation. When I transitioned to SNL, I supported scientists and engineers that were creating the physical protection and helped engage on the response. We realized we needed to improve this. Now let's look at integrating response better. In the last five years, we've done a much better job. We started the domestic 2020 cities initiative with ORS. We reach out to police departments, provide them with training courses, provided equipment, roll call videos, training aids, not just a two-day workshop. Unscripted roll of support to be adaptable and be creative with customized solutions."[91]

Mr. Thompson continued to illustrate how radiological security in areas like response at the local level has evolved substantially over the last 15 years. Planning documents were written, security enhancements were developed, coordination designations were made, and even an interagency that had formerly been

[91] Thompson, Matt. Personal Interview. April 3, 2020

notoriously stove piped has continued to improve and embrace information sharing as a way to increase radiological security since 2000.

Internationally, policies and plans have also adapted to address the threat posed by radioactive material, which includes placing a priority on developing efficient response procedures. High Income countries are better suited to prepare and deal with radiological security incidents, but it remains a complex problem. To provide how other high-income countries fare in this area, John Buchanan, the Radiological Nuclear Terrorism Prevention Unit Coordinator at INTERPOL in Europe, provided his perspective:

> "In the UK, from a Law Enforcement (LE) perspective, I started in 1982, big focus on nuclear disarmament, in terms of response of country. Nobody knew anything about the fixed sites, nuclear facilities. Nobody had an awareness on radiological fundamentals, what sources were in hospitals, at universities. As a patrol officer, if something happened, you had no warning or guidance if there was a radiological response. It was an ad hoc approach. In 2001, 9/11 was the changing point in the world. Even then in the UK, there was need for radiological specialists in intelligence. It wasn't available to first responders. CBRN wasn't a focus until 2009-2010, the we started with LE training on CBRN, physical security and terrorist attacks. The Federal government would then go and look at vulnerability and response plans. They would still mark these documents as secret which didn't allow for great coordination and integration. Still an issue in the UK because the greater response community wasn't trained to deal with radiological security. This changed in 2011, with the move to declassify that information to confidential, which meant it could be passed on to LE departments.
>
> From a country perspective, the only thing you could be at that time was reactive and not proactive. You'd be reacting to a potential radiological security incident but knew nothing about what you were responding to. You would have to go to the site and then reach back out to technical reach back. Now sites have plans available to provide responders. Now there is a preventative side."[92]

[92] Buchanan, John. Personal Interview. March 30, 2020.

Mr. Buchanan's thoughts have been echoed by many agencies in the U.S. as well as in other countries around the world. Countries without the same funding levels dedicated to radiological security such as the U.S. and the U.K. are even further behind the curve when it comes to radiological security. The U.S., and specifically ORS as well as many other U.S. agencies, has taken a proactive role to support this cause. These agencies have been helping countries develop security plans, distribute these plans, provide technical training, and improve the radiological security culture.

The FBI is the second agency of significance within the U.S. government's radiological incident structure. The FBI is the lead Federal response agency involving a radiological security incident with regards to the Law Enforcement and Investigation mission. Recognizing the need to elevate WMD matters with a focus on a more cohesive and coordinated approach, the FBI's Weapons of Mass Destruction Directorate (WMDD) was formed in 2005 by then Director Robert S. Mueller. The mission of the WMDD is to ensure the FBI and its partners are prepared to anticipate, mitigate, disrupt, or respond to WMD threats. With the continued evolution of the WMD threat and the possibility of an overseas origin or nexus to terrorism, the WMDD advances WMD prevention activities by supporting international WMD capacity building, developing plans and policies at strategic and operational levels, and developing partnerships, training, and outreach endeavors. WMDD has three sections of note:

- **Countermeasures:** The WMDD conducts prevention and outreach activities through FBI agents who serve as WMD coordinators in each of the FBI's 56 field offices across the U.S. Through these representatives, the Directorate

heightens awareness of WMD threats, develops liaison relationships to mitigate these threats, and uses those relationships to identify evolving WMD threats. These liaison relationships are particularly critical in keeping the FBI abreast of new WMD threats and potential security vulnerabilities associated with technological advances. Tripwires are one example of a specialized, coordinated type of outreach where the FBI develops a network of experts—in law enforcement, public health, and industry, for instance—to assist if a threat emerges.

- **Investigations and Operations:** The WMDD investigates violations of WMD-related statutes and is responsible for coordinating, planning, training, and leading the FBI's response to the use or threatened use of WMD threats and incidents as a means of terrorism. The Investigations and Operations Section (IOS) within the WMDD is composed of six units that provide strategic management and oversight of the FBI's WMD program. The IOS is also responsible for operational response planning and coordination in support of field investigations and the mitigation of WMD threats and incidents. The IOS fields three regional WMD assistant legal attachés who address WMD and counterproliferation situations by providing training at host government's request and ensuring a timely response for assistance to legal attachés and WMD events if pertinent.
- **Intelligence:** The WMDD is staffed with a cadre of analysts who develop relevant, timely, actionable intelligence to identify, understand, and articulate WMD threats and vulnerabilities. The Directorate's intelligence analysts provide WMD subject-matter expertise and apply it to advise investigations and the U.S. Intelligence Community (USIC) regarding international and domestic terrorism, criminal/lone actors, critical infrastructure, and counterproliferation. WMDD analysts are involved in all aspects of the WMDD mission by providing strategic, domain, collection, and tactical analysis to WMD investigations and responses to WMD critical incidents.[93]

The FBI's WMDD has provided a significant role in improving radiological security and response over the last 15 years. For perspective, former Unit Chief and Supervisory Special Agent at the FBI, Ms. Piersanti, shared this:

> "Then in 2006, FBI set up the WMDD. This helped the interagency because it had a dedicated force to reach out to DOE and DoD regarding radioactive materials… the full gambit at NNSA. We also started work with DTRA on homeland defense (anything domestic) and nuclear matters. In 2007, we started recognizing the need for integration in planning. We had to have a plan for implementation with interagency as well as state and local. I joined WMDD in 2007 and recognized these silos in planning and coordination. We had a TTX

[93] Federal Bureau of Investigation. Weapons of Mass Destruction Directorate marks 10 years. July 25, 2016.

series which we used that to gain awareness on the need for integrated plans at the senior level. There was reluctance to voice that was a gap in these plans.

Next phase was integrated planning that could bring everyone together in a unified command structure to be at the ready for these threats. We were able to bring in state and local, give them security clearances, and have them prepare with the federal level. It had to move into the PPD-8 construct. PPD-8 brought everyone together. NRF was formed from that. The WMDD was a driving force for building a radiological security culture. The bureau was standing up WMD coordinators. The WMD coordinators respond to all things WMDs. They had assistants too that were strategically placed. They were trained across the U.S. They were being heavily trained at the Remote Sensing Lab at the Nevada National Security Site for technical detection. So, a lot of the material was vulnerable across the U.S. A lot of issues that come into play. We started looking at potential targets such as radioactive material at sites and during transportation as well as potential targets for use. We would use trip wires, detection platforms, and countermeasures, plans and responses. WMDD put a programmatic effort at looking at acquisition sites and how to stop the threat in 2006. Then we looked at target sites.

Eventually, we developed a common operating picture at a national level. We became more sophisticated with planning. We had frameworks for state and local agencies. Prevention, Protection, and Response. All of the annexes were developed around these ideas. The Nuclear and radiological incident annex, for instance. Emergency Support Functions, where you can surge response to a certain event. Then, more sophisticated integration with FEMA for both threat and consequence. We recognized we had silos. Building an integrated line of effort that brought in the interagency. Multiple lines of effort being added. Intel and counterterrorism. Strategic level being integrated. The key is planning. Policy helps, but integrated planning is critical. TTXs are a tool and a means to get to a plan. To actually secure radioactive material, I think the ORS model is good. Protect, Remove, Reduce. I think it is spot on. If the threat is not necessary, think of all of the agencies that have to try to protect it or respond to it. The less of these materials you have, the less burden exists."[94]

Ms. Piersanti provides a prospective of how U.S. agencies like the FBI and ORS are developing and implementing plans and strategies that are proactive and looking to get ahead of the radiological security problem.

[94] Piersanti, Pamela. Interview.

The final agency that plays a significant role in the U.S. government's response and preparedness architecture is the DHS's Countering Weapons of Mass Destruction (CWMD) Office, formerly the Domestic Nuclear Detection Office (DNDO). This title change and reorganization was done in order to bring additional WMD material under the office's purview (biological and chemical threats, for instance). DNDO was significant with developing and aiding radiological security policy. DNDO was the primary entity in the U.S. government for implementing nuclear detection efforts during a coordinated response to radiological and nuclear threats, as well as integrating Federal nuclear forensics programs.[95]

DNDO was formed in 2005 and focused on increasing detection capabilities in physically vulnerable areas as part of a comprehensive strategy to protect against domestic radiological and nuclear threats; for instance, at ports of entry, between ports of entry, on small maritime vessels, in the general aviation sector, and the domestic interior. DNDO was a jointly staffed, national office organized under the DHS comprised of detailees and liaisons from:

- Department of Energy
- Department of Defense
- Department of Justice/Federal Bureau of Investigation
- Department of State
- Nuclear Regulatory Commission

DNDO also works with and has detailees from other DHS components such as the U.S. Coast Guard, Customs and Border Protection, Transportation Security Administration, and state and local entities. Additionally, DNDO was charged with coordinating the development of the global nuclear detection and reporting

[95] Department of Homeland Security. Domestic Nuclear Detection Office. June 18, 2016

architecture, with partners from Federal, state, local, international governments, and the private sector.[96]

Some of the Directorates within DNDO included support such as:

- Providing national-level stewardship, centralized planning and integration for an enduring national technical nuclear forensics capability.
- Determines gaps and vulnerabilities in the existing global nuclear detection architecture, then formulates recommendations and plans to develop an enhanced architecture.
- Carrying out the engineering development, production, developmental logistics, procurement and deployment of current and next-generation nuclear detection systems.
- Conducting, supporting, coordinating, and encourages an aggressive, long-term research and development program to address significant architectural and technical challenges unresolved by R&D efforts on the near horizon.
- Developing the information sharing and analytical tools necessary to create a fully integrated operating environment.
- Ensuring that DNDO proposes sound technical solutions and thoroughly understands systems performance and potential vulnerabilities prior to deploying those technologies.
- Independently assessing the operational performance of planned and deployed capabilities, including technologies, procedures, and protocols.[97]

DNDO's role in domestic response and preparedness has been significant to the country and specifically state and local government agencies. One program that specifically addresses radiological security has been the Securing the Cities (STC) effort to protect the Nation against the malicious use of nuclear and other radioactive materials. It seeks to reduce the risk of a successful deployment of a radiological or nuclear weapon against major metropolitan areas in the United States. The program

[96] Ibid

[97] CBRNE Central. Domestic Nuclear Detection Office. Accessed April 11, 2020.

assists state and local partner agencies as they build regional capabilities to detect, analyze, and report nuclear and other radioactive materials. [98]

DHS has continued to evolve its policies regarding preparedness, response, and coordination to radiological security along with other agencies within the U.S. Government. Changing DNDO to CWMD and incorporating lessons learned across the chemical, biological, and radiological/nuclear spectrums is one example of this evolution. Implementing radiological security efforts is not just a DHS responsibility, it is shared across all agencies and levels of government and private industry that license, use, and respond to radioactive material.

This chapter contends that the U.S.' current radiological security strategy was born in the early 2000s. This strategy hit rapid growth through the 2010s and has matured in the last 5 years with all aspects of planning, coordination, and response working together in a collective system.

It has taken the better part the last 20 years to build a security culture around radioactive material. The U.S. and most countries around the world are still in an infancy stage with regards to radiological security relative to many other fields, so, the U.S. has and will continue to face struggles with improving planning, coordination, response, and security around radioactive materials. DHS, NNSA, and the FBI (as well as countless others) have provided a significant transition for our country in becoming more proactive and better preparing the U.S. for a potential terrorism incident involving radioactive materials.

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[98] Department of Homeland Security. Securing the Cities Program. September 14, 2015.

Over the last 20 years, agencies have been formed and have built up guidance and planning documents to better prepare all levels of government for radiological security events. The improved coordination of command, control and integration is evident through improved interagency collaboration, revisions to key U.S. guidance documents, and the practicing of a response involving a radiological incident among key agencies at all levels of government.

To actually work through radiological security plans and test them, the U.S. uses a variety of exercise programs. For NNSA and the FBI, WMD counterterrorism exercise programs that focus on site or mobile radiological security issues advance the awareness, coordination, and planning to radiological security incidents necessary between the Federal, state, and local levels of government.

At a national level, the National Exercise Program (NEP) is mandated by Congress to test and strengthen Federal, state and local government ability to respond to potential catastrophic events. The NEP is a two-year cycle of exercises across the nation that examine and validate capabilities in all preparedness mission areas. Each NEP cycle is guided by Principals' Strategic Priorities, established by the Principals Committee of the National Security Council and informed by preparedness data from jurisdictions across the nation. FEMA's National Exercise Division administers the NEP on behalf of the Federal government, facilitating the design, coordination, conduct, evaluation and analysis of NEP exercises.[99] The NEP has a 17-year history, in which it started under a program referred to as the TOPOFF Operations. TOPOFF, which was short for "Top Officials", had Governors,

[99] FEMA. National Exercise Program. 02/10/20

mayors, city managers, top Federal and state officials, and others play active roles in a simulated emergency event. It was sponsored by the US Department of Homeland Security Office for State and Local Government Coordination and designed to involve all levels of government as well as emergency service responders including police, fire, public health workers and others. States volunteered to participate in TOPOFF; two were chosen for each cycle.

TOPOFF transitioned to National Level Exercises in 2009 when FEMA announced that TOPOFF exercises will continue under a new name, Tier 1 National Level Exercise (NLE). These were conducted annually in accordance with the National Exercise Program (NEP). The exercises were designed to provide all levels of government an opportunity to prepare for crises ranging from terrorism to natural disasters. In 2012, the National Level Exercise (NLE) changes its name to the Capstone Exercise. Finally, in **January 2017, the name was changed to the** National Exercise Program.

Transition to better radiological security

The questions still lingers; how do we further improve our radiological security posture in the U.S.? We've come a long way in 20 years. To quote Mr. Glick on how far we have come as a country, he states:

> "When the government moved from ad hoc planning to a more holistic and comprehensive planning approach to critical incidents, it greatly improved its ability to prepare for and respond to such incidents. When the USG further developed a more strategic approach to preparedness, one which emphasized "whole of government" thinking, not only horizontally across the federal government, but from a vertical perspective as well, that looked at the integration of federal, state, local, tribal and territorial authorities and resources, this further enhanced the USG's ability to respond to critical incidents. I've personally seen this evolution from the Clinton and Bush

> Administrations through the Obama and Trump Administrations. The most recent example is the change within DHS that sought to combine all WMD-related support efforts in one centralized organizational structure. When the Congress approved the movement of DNDO authorities to a new C-WMD Office, it created a new opportunity for DHS to develop expertise across the entire CBRN spectrum. While there is always room for further growth and improvement across the USG, in my view, and looking back on the last 20 years, the federal government has absolutely improved its ability to prepare and respond to radiological and other WMD-related incidents."[100]

Now that we have the framework, infrastructure, coordination, and tools finally in place, how do we better protect the U.S. from these incidents. I submit that exercising plans and coordination is the most effective way to test a plan or policy and identify gaps before a real-world incident exposes them for us. However, to ensure that these exercises are objectively successful investments, we still need to determine if said exercises are actually effective and not just taking place for the sake of checking a box. The next chapter will examine how exercise programs and their planners can better support U.S. Federal agencies with exercises that produce measurably effective outcomes.

[100] Glick, Scott. Interview

Chapter 3.

Tabletop exercises: Are they effective?

***[Note to Reader:** As noted earlier, this chapter was written, accepted for submission, and graded at the end of 2012. The innovative rubric that is discussed in this chapter has even more relevance today than when it was written, particularly in light of the response to the Coronavirus and recent news reports that have discussed the effectiveness of tabletop exercises that were conducted in January 2017 during the transition between the Obama and Trump Administration. As a result, following the submission of this thesis, I intend to consult with additional experts and further refine this rubric to support the company I run and the broader exercise community.]*

Conducting exercises to test preparedness is by no means a revolutionary. Exercises and simulations have been utilized to prepare for a variety of dating well beyond the last two centuries. This chapter will highlight some of the various forms of exercises and training used to prepare for disasters and specifically look at whether tabletop exercises are an effective form in preparing organizations for a disaster. Lastly, this chapter will discuss the various forms of evaluation and suggest a new method of evaluation.

Over the last 40 years, the United States has endured multiple large-scale disasters to include natural disasters like Hurricanes Andrew and Katrina to terrorist attacks that include the Oklahoma City Murrah Building bombing and the 9/11 attacks on World Trade Center and the Pentagon; and embassy bombings in the 80s and 90s. These disasters resulted in large number of casualties, significant cost to public and private entities, and a lot of scrutiny on how government agencies respond to these disasters. Keeping this in mind, ensuring exercises, including tabletop exercises, are effective should be a priority for the exercise planners and

organizations to not only be prepared for a disaster, but to also ensure monies spent by the governments or organizations are spent wisely.

This chapter will again provide some background on how the U.S. Government altered policies and laws based on significant events and how they relate to the evolution of exercises. Additionally, this chapter highlights methods used in determining effectiveness for tabletop exercises that include qualitative assessments and introduce some quantitative assessments such as devising a rubric and some alternate suggestions. To begin though, the various types of training utilized to prepare for disasters will be introduced and with tabletop exercises being the primary point of discussion.

Types of Exercises and Training

As seen in human-caused events such as the 9/11 attacks, the Virginia Tech, Columbine, and Aurora, CO. shootings, as well as natural events such as "Snowmageddon," the name used to describe the various blizzards impacting parts of the world in the last four years, hurricanes, and earthquakes, response assets are tasked with handling the crisis and consequence results. To prepare for numerous scenarios, response assets take part in all forms of training that range from Discussion-Based to Operations-Based exercises which include the actual deployment of resources.[101] Each form of training exercise has unique goals and characteristics of conduct.[102] Below, table 1 describes discussion-based exercises and table 2 describes operations-based exercises.

[101] Fema, 2013. Introduction to Exercises. http://training.fema.gov/EMIWeb/IS/IS120A/IS_120A.pdf (Date accessed 02/26/2013)
[102] Ibid

Table 1: Discussion-Based Exercises

Type	*Goals & Characteristics*
Seminars	A casual exercise led by a presenter or facilitator, used to teach or orientate participants.[103]
Workshops	More formal than a seminar and is used to build or achieve a product. Typically includes more participant discussion and often uses breakout sessions.[104]
Tabletop Exercise	An informal group discussion for senior staff, appointed officials or other key personnel to work through realistic hypothetical scenarios. Goals include identifying gaps and looking to walking through situations and try out new concepts. Some characteristics include an in-depth discussion that can be observed by an audience or observers and requires an experienced facilitator.[105]
Games	An exploration of the processes and consequences of decision-making using "what-if" analyses to test existing or potential strategies. Often involves two or more teams but does not involve the use of actual resources.[106]

Table 1: Discussion-Based Exercises

Table 2: Operations-Based Exercises

Type	*Goals & Characteristics*
Drills	A supervised activity that tests a specific operation or function of a single agency to gain training on new equipment, new procedure, practice or maintain skills, or preparation. Drills are normally conducted in a realistic but isolated environment and provide immediate feedback.[107]
Functional Exercise	A single or multi-agency activity designed to evaluate capabilities and multiple functions in a highly stressful environment using simulated response to assess the adequacy of response plans and resources.
Full-Scale Exercise	A high-stress multi-agency, multi-jurisdictional activity involving actual deployment of resources in a coordinated response to a

[103] ibid
[104] ibid
[105] ibid
[106] ibid
[107] ibid

scripted realistic exercise scenario. The goal of the exercise is to assess and evaluate plans, procedures and response under crisis conditions.[108]

Table 2: Operations-Based Exercises

Exercises play a vital role in preparedness by enabling stakeholders to test and validate plans and capabilities and identify both capability gaps and areas for improvement. A well-designed exercise provides a low-risk environment to test capabilities, familiarize personnel with roles and responsibilities, and foster meaningful interaction and across organizations.[109] Exercises bring together and strengthen the responders in their efforts to prevent, protect/deter, mitigate, respond to, and recover from all hazards. Overall, exercises are cost-effective and useful tools that help the nation or an organization practice and refine our collective capacity to achieve the core capabilities preparedness goals.[110]

Because most of the expertise utilized in the contribution to this paper originates from tabletop exercise experience, this paper will focus on tabletop exercises and pose the question of whether they are an effective form of preparing response assets. Tabletop exercises can be as much as 10 times less expensive than a full-scale exercise and may be able to address issues and plans with stakeholders that have the ability to make appropriate organizational changes. Additionally, by solely focusing on tabletops, the successes and limitations of these exercises can be thoroughly examined and evaluated for their effectiveness.

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[108] ibid

[109] FEMA. Homeland Security Exercise and Evaluation Program. https://hseep.dhs.gov/pages/1001_About.aspx (Date accessed 5/1/2013)

[110] Ibid

The Importance of Conducting Exercises

Significant events over the past four decades have put pressure on the United States government to exercise response and preparedness. Attacks both domestically and internationally have pushed legislation into domestic resilience, combating terrorism, incident command, and disaster preparedness. In the 1980's, the U.S. saw a rise of state-sponsored terrorism that included the following:

1. In 1983, the United States embassy in Beirut, Lebanon was bombed, killing 63 people, mostly embassy and CIA staff members, as well as several soldiers and one Marine. 17 of the dead were Americans.[111]
2. In 1984, the Achille Lauro cruise ship was seized by a terrorist group known by the Palestine Liberation Front (PLF), holding 700 hostages, mostly Americans; 1 death.[112]
3. In 1985, TWA 847 flight hijacked; 1 death when a U.S Navy Diver was killed and tossed on to the Tarmac in Beirut, Lebanon.[113]
4. In December 1988, Pan Am 103 was bombed and exploded over Lockerbie, UK, killing all 270 people on board residing from 21 different countries.[114]

In 1985 Vice President George Bush created "Vice President's Task Force on Combating Terrorism" as the first end-to-end review focused on joint/interagency Counter Terrorism response assets coordination. This review resulted in the passing

[111] Silent Thunder Terrorism Brief
[112] The Vice President's Task Force on Combating Terrorism Report. The White House. July 20, 1985. http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB55/nsdd179.pdf (Date accessed 05/01/2013)
[113] ibid
[114] Terrorist Bombing of Pan Am Flight 103. Central Intelligence Agency. July 23, 2012. https://www.cia.gov/about-cia/cia-museum/experience-the-collection/text-version/stories/terrorist-bombing-of-pan-am-flight-103.html (Date accessed 05/05/2012)

of National Security Decision Directive 207 on Jan 20, 1986, where the U.S. National terrorism program first defined: "U.S. Program on Combating Terrorism" crisis response to incidents overseas, ultimately guiding U.S. strategy for the next decade.[115] Terrorism and other disasters continued to be the catalyst to push legislation and directives over the next 25 years, including the passing of several presidential policy directives discussed in the first two chapters that identified the need for better response and preparedness by first responders and follow-on response during a crisis. Some of the legislation and policy directives specifically site the need for conducting tabletop exercises to help prepare for similar disasters.

Terrorism

In 1996, in response to the Tokyo sarin gas attacks and the Oklahoma City bombing, we again discuss President Bill Clinton's issuing of Presidential Decision Directive (PDD) 39 due to relevance. Essentially, it stated it is the policy of the United States to "deter, defeat and respond vigorously to all terrorist attacks on our territory and against our citizens, or facilities, whether they occur domestically, in international waters or airspace or on foreign territory... the U.S. shall pursue vigorously efforts to deter and preempt, apprehend and prosecute, or assist other governments to prosecute, individuals who perpetrate or plan to perpetrate such attacks."[116]

[115] NSDD 207, The National Program for Combating Terrorism. 1986. The White House. http://www.fas.org/irp/offdocs/nsdd/nsdd-207.pdf. (Date accessed 05/02/2013)
[116] PPD-39. U.S. Policy on Counterterrorism. June 21, 1995. http://www.fas.org/irp/offdocs/pdd39.htm (Date accessed 02/25/2013)

Around that same time, many Congressional committees and subcommittees met on topics such as National Security and Combating Terrorism. One of the programs discussed that demonstrated the expanded role of the government in domestic preparedness is the Nunn-Lugar-Domenici Preparedness Program. This program rose from the Defense Against Weapons of Mass Destruction Act of 1996 signed by President Clinton.[117] This program looked to provide training for possible incidents involving terrorists using Weapons of Mass Destruction (WMD).[118] From this, the Department of Defense and Federal agencies were provided millions of dollars to conduct training, including tabletop exercises, in 140 cities across the U.S.[119]

Disasters and National Level Exercises

In 2005, Hurricane Katrina was considered the most destructive and costly hurricane to hit the United States, with damage estimated at $125 billion and 1,500 deaths across four states.[120] Part of the blame is claimed to be from poor communication and response to this disaster, as the Committee on Homeland Security and Governmental Affairs cited the failure of government at all levels to plan, prepare for, and respond aggressively to the storm.[121] Specifically, they stated that four overarching factors contributed to the failures. These are:

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[117] Findings of the Nunn-Lugar-Domenici. September 23, 1995. www.rand.org/content/dam/rand/pubs/.../MR1251.AppE.pdf (Date accessed 02/28/2013)
[118] Observations on the Nunn-Lugar-Domenici Domestic Preparedness Program. October 2, 1998. http://www.gao.gov/products/T-NSIAD-99-16 (Date accessed 02/28/2013)
[119] Ibid
[120] Hurricane Katrina. February 12, 2007. http://www.katrina.noaa.gov/ (Date accessed 02/26/2013)
[121] Special Report of the Committee on Homeland Security and Governmental Affairs. Hurricane Katrina: A Nation Still Unprepared. 2006. www.gpo.gov/fdsys/pkg/CRPT-109srpt322/.../CRPT-109srpt322.pdf (Date accessed 03/01/2013)

1. Long-term warnings went unheeded, and government officials neglected their duties to prepare for a forewarned catastrophe;

2. Government officials took insufficient actions or made poor decisions in the days immediately before and after landfall;

3. Systems on which officials relied on to support their response efforts failed; and

4. Government officials at all levels failed to provide effective leadership.[122]

The report stated that preparation plans and response were inefficient and not well devised. Additionally, the report stated that the government had been insufficiently conducting training and exercises. In 2005, DHS assumed full responsibility for planning, conducting, and after-action reporting of the National Exercise Program, known then as the Top Officials exercises or TOPOFF exercises.[123] In April 2005, DHS had implemented TOPOFF3 or the third tabletop exercise in the series which was designed to identify vulnerabilities in the Nation's domestic incident management capability including the structure of the NRP.[124] The NRP originated from Homeland Security Presidential Directive – 5 and was directed by President Bush to align Federal coordination structures, capabilities, and resources into a unified, all-discipline, and all-hazards approach to domestic incident management which was discussed in our last chapter.[125]

Exercises needed if done effectively

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[122] Ibid

[123] DHS Efforts To Address Lessons Learned in the Aftermath of Top Officials Exercises. Department of Homeland Security. January 2009. http://www.oig.dhs.gov/assets/Mgmt/OIG_09-53_Apr09.pdf. (Date accessed 05/02/2013)

[124] Special Report of the Committee on Homeland Security and Governmental Affairs. Hurricane Katrina: A Nation Still Unprepared.

[125] DHS. National Response Plan. December 2004. http://www.it.ojp.gov/fusioncenterguidelines/NRPbaseplan.pdf (Date accessed 12/27/2013)

In response to the exercise, the Department of Homeland Security (DHS) Inspector General stated in November 2005: "the exercise highlighted – at all levels of government – a fundamental lack of understanding for the principles and protocols set forth in the NRP and the NIMS."[126] This identified confusion provoked discussion and demonstrated the importance of conducting exercises. The absence of exercises in the NRP meant that there were no further formal opportunities to understand potential problems and to incorporate lessons learned into the NRP.[127] From these gaps, DHS through FEMA, dropped the NRP in exchange for the National Response Framework (NRF).[128]

The NRP was cited as being "insufficiently national in its focus… and …should speak more clearly to the roles and responsibilities of all parties involved in response."[129] This NRF is further covered in the previous chapter and was expanded on with the signing of PPD 8 by President Obama, which in essence, integrated the National Preparedness Goal and focused on an integrated, all-of-Nation, capabilities-based approach to all-hazard preparedness which can include, but are not limited to, the use of tabletop exercises as a form of preparation.[130]

One thing Katrina did was reveal the impact that a lack of an effectively trained and exercised plan, as well as not practicing the interoperability of

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[126] Special Report Of the Committee on Homeland Security and Governmental Affairs. Hurricane Katrina: A Nation Still Unprepared

[127] Ibid

[128] DHS. National Response Framework. January 2008. http://www.fema.gov/pdf/emergency/nrf/nrf-core.pdf

[129] DHS. National Response Framework. January 2008. http://www.fema.gov/pdf/emergency/nrf/nrf-core.pdf

[130] PPD 8. National Preparedness. March 2013. http://www.dhs.gov/presidential-policy-directive-8-national-preparedness (Date access 03/01/2013)

communications will further undermine the response.[131] As part of the Committee on Homeland Security and Governmental Affairs, several recommendations were made to improve response, coordination and preparedness. Of those, the committee recommended that "Federal departments and agencies should be required to conduct exercises to ensure that their plans are continually revised and updated," as well as "emergency agencies at the federal, state, and local levels of government, as well as first-responder groups outside of government, should receive regular training on NRP and NIMS."[132] It is important to note that the NRP is considered the foundation of the NRF and it built upon, not entirely rebuilt, the national framework previously established.

Despite these problems, not all was a loss when, in 2005, DHS developed the Universal Task List (UTL) and Target Capabilities List (TCL). The UTL helps exercise participants and planners by describing incident management tasks to be performed and provide them with a standardized reference for all levels of government and the private sector. The TCL contains capabilities that various levels of government need to develop and maintain to prevent, respond to, and recover from a terrorist attack or major disaster.[133] These two lists have proven useful to this day in all types and levels of exercise.

Exercise Progress

[131] Special Report Of the Committee on Homeland Security and Governmental Affairs. Hurricane Katrina: A Nation Still Unprepared

[132] ibid

[133] DHS Efforts To Address Lessons Learned in the Aftermath of Top Officials Exercises. Department of Homeland Security.

Through the lessons learned in the 1990s and the first decade of this century, exercises have been identified as a valuable tool for preparedness. These lessons have shown the importance of addressing command and control during a crisis situation and working through scenarios such as a nuclear or radiological incident or a major storm. This progress has not always been so positive. The final after-action report recommendations from the TOPOFF3 exercise failed to include improvement planning to address remedial needs and corrective action procedures which were not a part of the original evaluation. It only informed participating departments and agencies of existing problems, and encouraged improvements in agency prevention, response, and recovery capabilities. Furthermore, after-action reports, best practices, and lessons learned from the TOPOFF3 exercise have not been disseminated to a broad national audience.[134]

Despite some of the problems stated, there is still great need for response agencies' personnel to exercise their plans and prepare for disasters. For the response assets to take part in these exercises, it comes at the cost of government spending. When Sequestration is taking effect or budgetary uncertainty lingers, training value needs to be maximized for ultimate effectiveness.[135] One cost-effective solution to providing an exercise that helps identify gaps or vulnerabilities in plans and preparedness are tabletop exercises. Tabletop exercises have evolved to incorporate the most important objectives and have been proven to be effective at

[134] Ibid

[135] CSA tells senators sequestration would impact readiness. February 12. http://www.army.mil/article/96365/CSA_tells_senators_sequestration_would_impact_readiness/ (Date accessed 02/20/2013)

training personnel without a large cost or resource commitment.[136] The difference in costs between a field exercise that requires the deployment of assets and a tabletop exercises can be as much as ten times.[137] Despite this, field exercises are still necessary to ensure front line response and command post officials are able to handle their tasks and responsibilities in a stress added situation.[138] So, can tabletop exercises provide an effective training and exercising of plans and procedures needed for response assets to prepare for a disaster? Furthermore, how do we know this to be true from a discussion-based exercise?

Evaluating Tabletop Exercise Effectiveness

Despite the number of years tabletop exercises have been utilized for preparedness, only unreliable formal evaluation systems had existed until the creation of the DHS's/FEMA Homeland Security Exercise and Evaluation Program (HSEEP) in 2005.[139] This has been problematic and is characterized in a statement by Department of Homeland Security's Office of Inspector General in an Executive Summary regarding DHS Efforts to Address Lessons Learned written in the Aftermath of Top Officials Exercises:[140]

> "Since the first Top Officials exercises in 2000, neither a process for tracking weaknesses and how those weaknesses were resolved, nor a method for identifying and analyzing trends in corrective actions or significant lessons learned has been established. As a result, federal, state, local, and territorial agencies were unclear regarding the

[136] FEMA. Exercise Design.
[137] Joe Schwartzel interview
[138] Ibid
[139] FEMA. Homeland Security Exercise and Evaluation Program. April 2012. https://hseep.dhs.gov/pages/1001_About.aspx (Date accessed 03/01/2013)
[140]DHS. DHS Efforts to Address Lessons Learned in the Aftermath of Top Officials Exercises

implementation of suggested improvements following preparedness exercises."

FEMA developed a standardized program that includes common terminology for exercise design, development, conduct, evaluation, and improvement planning.[141]

One of the benefits from this program is support organizations can achieve objective assessments of their capabilities. Strengths and areas for improvement are identified, corrected, and shared appropriately prior to a real incident.[142] This can be a strength of the program but must still be monitored and utilized effectively. DHS Office of Inspector again cited problems with the program in a review titled "FEMA's Management of Corrective Actions and Lessons Learned from National Level Exercises", stating:

> "FEMA did not consistently track and manage corrective actions assigned to it resulting from exercises carried out in 2007 and 2009, nor did it finalize and implement guidance for doing so. Furthermore, fewer than 40 percent of corrective actions resulting from these exercises, many of which FEMA was responsible for completing, were completed. FEMA also did not adequately validate corrective actions to improve planning and disaster response. Finally, FEMA did not sufficiently disseminate information on agency specific lessons learned. As a result, FEMA missed opportunities to validate its actions in future exercises and actual events, learn from and apply the experiences of its personnel, and improve its incident management operations."[143]

What's the alternative?

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[141] FEMA. HSEEP

[142] Ibid

[143] FEMA's Management of Corrective Actions and Lessons Learned From National Level Exercises. DHS. September 2012. http://www.oig.dhs.gov/assets/Mgmt/2012/OIG_12-118_Sep12.pdf. (Date accessed 05/01/2013)

No program will offer a perfect solution and all programs will necessitate the organizations involved to follow through with improvement planning. Some of the issues that surround evaluated exercises can be the willingness of players to admit gaps or identify exercise objectives that might show weakness. One potential solution is no-fault, non-attribution exercises. These exercises are not considered an HSEEP exercise, but can include exercise participants to self-evaluate exercise play during hotwashes (post exercise discussions), after-action reviews, and improvement planning meetings.

One example of these no fault TTXs come from the *Isotope Crossroad* exercise series cosponsored by NNSA and the FBI. In an exercise Isotope Crossroads: Montana conducted on March 3, 2020, conducted in Helena, Montana, with the primary objective to bring federal, state and local agencies together to walk through and exercise a security incident involving the transportation of radioactive material across Montana. 77 participants from a total of 40 federal, state, and local agencies in areas of law enforcement, disaster and emergency services, local and state governments, military, health physics, and firefighting. Some of the discussion in the exercise included Interagency intelligence/information sharing surrounding a radiological incident as well as response plans. Lessons learned gathered from a post exercise discussion provided qualitative data along with surveys and polling providing quantifiable information.[144]

This important data can be gathered for areas of improvement to produce metrics in qualitative and quantitative forms with the use of questionnaires, polling,

[144] "Isotope Crossroads: Montana" March 03, 2020

narratives, logs, checklists, or surveys.[145] A lot of progress has been made over the last two decades to improve these techniques and forms, and significant data has been gathered from these methods. But do these techniques and forms answer the question on whether the exercise was effective? Do they help identify any expected results from exercise objectives? Unexpected results? This analysis will be looked at further in the evidence section.

Some of the goals for a tabletop exercises could be to evaluate policies, plans, and procedures,[146] it is vital that metrics are collected. Polling, questionnaires or surveys are able to gather response from participants or players, but do they provide the end user any meaningful data that determines if the exercise was effective?

Common Evaluation

Common to all tabletop exercises is the debriefing portion of the event, commonly called "the hotwash". A hotwash is an opportunity for participants to provide their inputs on how well the exercise went, what plans or procedures should be changed, lessons learned, and make commitments on changes they see are appropriate.[147] It is common for an exercise to be followed by an evaluation meeting and may include an after-action report stating findings of the evaluation team and the effectiveness of the exercise. It serves as the basis for planning future exercises, upgrading contingency plans, and taking corrective actions.[148]

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[145] FEMA. Exercise Design.
[146] Brown, Monica. Use of tabletop exercises for disaster preparedness Training. August 2010. http://digitalcommons.library.tmc.edu/dissertations/AAI1475678/ (Date accessed 03/01/2013)
[147] FEMA, Exercise Design, Unit 8
[148] Ibid

One of the greatest qualitative metrics gained during the debriefing or hotwash are the lessons learned. But these lessons learned could be irrelevant such as the lessons learned from the "Hurricane Pam" exercise conducted in 2005 prior to Hurricane Katrina, if they have not been properly implemented and communicated.[149] From the failures in information gathering and sharing, progress has been made in evaluating exercise effectiveness with the implementation of HSEEP.

Next Steps Toward Identifying Effectiveness

Substantial progress has been made in evaluating tabletop exercises, but more could be done. For one, it would be beneficial to gather more than just qualitative data. Quantitative data can be extremely beneficial for both private and public organizations. This data could be used to forecast improvement in response times and effort, identifying resource needs and training when gaps are identified, as well as aligning training budget concerns.

Secondly, the HSEEP program only applies to DHS-funded exercises and is not necessarily utilized for no-fault or exercises conducted outside of government mandated HSEEP exercises. Furthermore, HSEEP may not always be the solution. Exercises that are mandated to be evaluated such as HSEEP, have seen their share of problems which are highlighted in the Congressional Research Service Report for Congress titled "Homeland Emergency Preparedness and the National Exercise

[149] Mitigation Journal. Effective Tabletop Exercises. November 2010 http://www.mitigationjournal.org/2010/11/effective-tabletop-exercises.html (Date accessed 03/01/2013)

Program: Background, Policy Implications, and issues for Congress". Noted in the report was the following:

> *The identification of capabilities on which to build through a public AAR, as required by the HSEEP method, may raise challenges if exercise participants have not adequately exercised their plans, or are concerned about potential consequences as a result of negative evaluations. As a result, there may be incentives for some exercise planners to understate exercise objectives, overstate the extent to which those objectives are met, or to downplay or omit deficiencies that are identified. Any of those approaches arguably undermines the effectiveness of the exercise as tools to prepare for an incident, or to evaluate an entity's capacity to respond to an incident.*

This report does point out the possibility of a potential bias or incentive for planners and participants to not fully identify problems when an exercise is evaluated. This indication of bias may provide explanation for the need of including no-fault exercises which essentially allows all participants and players to work through the exercise in an open environment without penalty. The report further indicated:

> *The HSEEP method does not provide common benchmarks or metrics to apply in the evaluation of an exercise. Moreover, under the HSEEP method, exercises are typically evaluated by the same group that designs the exercise. This approach, which extends beyond the National Evaluation Program to any entity that uses the HSEEP method, may be problematic if the evaluators fail to critically asses their own program. [HSEEP has made some changes and improvements since the writing of this chapter. A new version published in January 2020 has improved some of the areas cited]*

So, is no evaluation the solution? One reasonable answer appears to be allowing for self-assessments to be conducted similar to what is done in no-fault tabletop exercises, but can these types of evaluations be done effectively? To determine if this is effective, it is necessary to analyze the current forms of evaluation for no-fault tabletop exercises.

Analysis

To assess the current forms of evaluating the effectiveness of no-fault exercises and offer alternatives, several individuals with a great deal of experience participating in and planning tabletop exercises were interviewed. This cadre includes former senior representatives with the Department of State, a Senior Policy Advisor to the White House and Department of Energy, a Deputy Under Secretary of the National Nuclear Security Administration, an Exercise Director with the Federal Bureau of Investigations, a former Navy SEAL, an Assistant Administrator for Protective Services and Security with the National Aeronautics and Space Administration, a hospital Emergency Manager, and a Senior Exercise Planner. These interviews yielded a broad and detailed view on how tabletop exercises are currently evaluated and how they could improve. Moreover, over 100 articles, governmental committee and subcommittee notes/reports, journals, after-action reports, and thesis were reviewed to gain a strong knowledge of how tabletop exercises are evaluated and whether they are effective.

Are qualitative assessments good enough?

Although no numeric rating may result from qualitative assessments and responses, one can certainly provide solid qualitative evidence that an exercise was effective through subjective post exercise evaluations/critiques provided by exercise participants. Though it can be subjective, the individuals interviewed also provided examples of how one can determine that an exercise was effective solely through qualitative response. Common qualitative examples discussed in the interviews as well as actual results from tabletop experience include:

- Teambuilding and familiarity among response assets and leadership – The tabletop exercise provides an opportunity for first responders and follow-on response to meet one another, sometimes for the first time, and get to know/build trust among one another. “Almost impossible to measure, but a tabletop exercise is invaluable because it is the relationships built between responders in an emergency. [A tabletop exercise] builds a trust between response.”[150]

- Knowledge gained of roles, responsibilities, and assets among responding parties – Deputy Under Secretary for the National Nuclear Security Administration Dr. Steve Aoki stated that taking part in tabletop exercises helped him in response guidance to Fukushima. The exercises he participated in provided him with the knowledge on the various response assets available and what assets could be called upon during a crisis/disaster. Additionally, the tabletop provided him with a venue to work through various scenarios. Furthermore, the Assistant Administrator at NASA, Mr. Mahaley, stated that he took part in a tabletop exercise that involved him contacting the White House during a disaster. This experience prepared him for an actual call that was needed while he was acting Director of Security for Energy during the blackout of 2003 that impacted much of the Northeast United States. He stated that experience provided him the opportunity to work through how a phone call to the White House would take place and understand who needed to be included in the call.

- Post-exercise lessons learned - things learned that were otherwise not know prior to the exercise. “For the after action review to be effective, the opportunity to incorporate recommended changes to site response plans and procedures should be a goal.”[151]A gap in a current security plan or procedure or a lack of understanding of a particular substance/organism often is identified through the course of tabletop exercise. This often results in a change in a plan/procedure or a group of people being more comfortable with response.

- Knowledge of a particular threat – i.e. group, source/material, attack. As stated from the conclusion of Maryland’s pandemic influenza preparedness exercise - It [*the tabletop exercise] served to engage the emergency response community and address the issues of incident command and how pandemic planning fits with the “all hazards” approach. The exercise also educated key partners and stakeholders, through an experiential approach, about the potential severe consequences of pandemic influenza, and it provided a forum to “drill down” beyond the current state plan and identify additional critical local planning activities that are needed. Instructive insights*

[150] Mahaley, Joe. Personal Interview. May 10, 2013

[151] Daly, Patrick. How to plan and conduct a table top exercise. 02/14/2013

and lessons were gained from the exercise that should bolster further planning efforts in Maryland, not only for pandemic influenza, but also for bioterrorism and other public health disasters.[152]

- Exercising plans in place – a tabletop exercise provides a venue for response to actually practice the plans and procedures in place to ensure they fully understand said plan/procedure and/or response to a disaster. Mr. Mahaley stated "You do what you are trained to do. In real life, you are going to react how you are trained. In my 40 years of experience, tabletop exercises provide the most effective form of training."[153]

This qualitative information is extremely vital and shows a tabletop exercise is effective, but this information is not always easy to gather. In almost every interview that was conducted, a common theme regarding the best way of obtaining great qualitative response was if the exercised remained no-fault or non-attributional, allowing an open, honest environment. The reasons stated included that assets are more likely to admit faults, vulnerabilities, or lack of understanding or a shortfall in a plan/procedure if they are not worried about their job.[154] This makes sense considering that participants may feel more comfortable speaking if they are not being graded. So, if a no-fault tabletop exercise yields the best qualitative responses, can it also provide quantitative results to determine effectiveness?

Quantitative assessments

Raw, not well developed, quantitative assessments currently exist in the tabletop community, but they are not well known and there is no standard. It would be useful to have standardized quantitative assessments to assist public and private

[152] Taylor, Jean Lin, Brenda J Roup, David Blythe, Greg K. Reed, Tiffany A. Tate, and Kristine A. Moore. Pandemic Influenza Preparedness in Maryland: Improving Readiness through a Tabletop Exercise. Maryland Department of Health and Mental Hygiene. Biosecurity and Bioterrorism. Volume 3, Number 1. 2005
[153] Mahaley, Joe. Interview.
[154] Daly, Pat. Interview

organizations determine if the money being spent by their organization is going to good use and the tabletop exercise is worth attending. With a lack of available quantitative metrics, it is prudent to look at ways to quantify the results of a tabletop exercise to compliment the qualitative data. Furthermore, for the purpose of this chapter, it was stated that exercises may be more effective being non-attributional, so we will also mull over this as the type of tabletop exercise being considered.

Suggested metrics

Three forms of quantitative assessments should be considered to assist government agencies and private organizations with determining effectiveness for a no-fault tabletop exercise. These include a pre- and post-test combination to help identify the percentage of improvement, a numeric count of observations during and post exercise, electronic polling of participants, and a rubric as an assessment tool.

Conducting a pre- and post- tests among players and observers (observers typically consist of other invited responders not sitting at the player's table) is a way to gauge a level of improvement in understanding, knowledge, and collaboration. Participants would take a test or survey to indicate their understanding of response to a disaster, level of knowledge on the particular threat, and how well they know who would be responding/in charge of a particular incident. Then following the tabletop exercise, the participants would take the same test and the results would be compared between the two. From that, a level of improvement could be gathered from the delta providing some quantitative gauge of exercise effectiveness.

Another potential way to gather quantitative data from a tabletop exercise can be in the form of counting the number of observations either during an exercise or

post exercise. During a no-fault exercise, an unbiased observer could be included not to grade or place fault, but to instead count the number of observations that a participant learned something, a vulnerability was identified, a gap in a plan or procedure was identified, or an agency stated they were unaware of a particular response or response asset. The observations could then be sorted and tallied. This could also be done post- exercise counting the number of changes made to plans, policies, or procedures, as well as anything else that may have resulted from the exercise experience.

Electronic polling of participants can be an effective way to gather specific data throughout an exercise. A variety of companies produce polling technology such as online formats in which the participant uses a smart phone and other formats in which the exercise facilitator provides the participants with polling equipment to log their selections. This information can be provided to the planners, government, and participants in real-time and provide a significant benefit to improvement planning.

The final suggestion that should be considered is an original contribution from the research for this chapter. This rubric was designed considering the great number of tasks and objectives that may be included in a tabletop exercise. Table 3 is shown in its full capacity in Appendix 1.

Exercise Effectiveness

Tasks	Lowest Quality (1 pt)	Average Quality (2 pts)	Best Quality (3 pts)	Score
Were the exercise objectives clear?	Exercise objectives were vague/unclear or were not well stated	some of the exercise objectives were clear while others were not.	Exercise objectives were clear and understandable	
Met Exercise objectives #1 - state objective	Objective 1 was not met or discussed	Objective 1 was partially met	Objective 1 was fully met	
Met Exercise objectives #2 - state objective	Objective 2 was not met or discussed	Objective 2 was partially met	Objective 2 was fully met	
Met Exercise objectives #3 - state objective	Objective 3 was not met or discussed	Objective 3 was partially met	Objective 3 was fully met	
Met Exercise objectives #4 - state objective	Objective 4 was not met or discussed	Objective 4 was partially met	Objective 4 was fully met	
Appropriate response participants were in attendance	Exercise did not have the appropriate participation in attendance	Some of the key agency and participants were in attendance	Almost all of the key agencies and participants participated or were in attendance	
Participation Level	Very little response from exercise players or observers	Moderate level of quality discussion and participation from players and observers	Excellent discussion and response from players and observers	
Were gaps in SOPs, plans or policies identified?	No gaps or problems in response of plans were identified	Some discussion of gaps in plans or procedures were identified	An important gap in a plan, policy, or procedure was identified	
Do you feel others identified lessons learned from the exercise?	There was no mention of learning from other participants	A couple of players indicated that the exercise offered some learning	Several players and observers indicated that the exercise provided them with lessons learned	
Do you feel leadership gained valuable expertise in response to the exercise scenario?	Site leadership and incident command/response seemed bored or unenthusiastic about the scenario	Site leadership and incident response/command enjoyed the scenario	Site leadership and incident command were challenged by the scenario	
Team Building among response assets	All response assets knew one another	Most of the agencies knew one another through normal interaction	The exercise provided a great opportunity to meet response assets who were unknown	
Understanding and clarity of Incident Command	Incident command was not established in the exercise	Incident command was identified a couple of times but was unclear at times who was in charge	Throughout the exercise incident command was well identified and established	
Was the exercise scenario realistic/believable?	The exercise was not well planned or believable	The exercise was some what believable and realistic	Great detail was utilized to provide a realistic and believable scenario	

Table 3: Exercise Effectiveness

Scoring Effectiveness, Using the Rubric

To utilize the rubric, exercise evaluators would develop the rubric based on objectives and tasks identified for the exercise. These objectives and tasks would be listed on the left and employ the descriptions listed beside the tasks to determine a score for the specific task or question listed. Each task would receive a 1 (lowest quality), 2 (average quality) or a 3 (highest quality) based on how well the tabletop exercise fulfilled the task. The culmination of the tasks/questions listed in the rubric should fulfill the purpose and goals of the exercise. Hence, a score toward the higher

end of the max scoring should indicate exercise effectiveness. In the example in Appendix 1, the minimum score would be a 20 with a maximum value of 60. Considering the range, a median score of at least 30 may indicate an effective exercise, but it would be up to the designer of the rubric to identify the threshold based on the number of tasks/questions listed and their respective values. One other suggestion to the rubric might be assigning a greater weighted value range for tasks/questions that have great importance.

Who should complete the rubric?

In this assessment, it would make sense to utilize two groups to fill out this form following the exercise. In the first group, the players should be considered the primary responder to the rubric. They will be the main focus and it will be their response to the exercise scenario that will be gauged. The rubric could remain anonymous since the exercise in no-fault and will not be a factor in gauging the results. Additionally, the tabletop exercise remaining no-fault may foster more honest response from the players. The second group that would complete the rubric consists of site agents that have expert knowledge and experience with tabletop exercises. They may be individuals that assist in the setup and reality design of the exercise but are not a part of the exercise planning/facilitation team and have no stake in how well the exercise performs. Ideally this would be someone who can observe the exercise, but one who is not a player or providing response during the exercise. Lastly, a combination of the two may be the best model. By obtaining a score from both the players and the site, one could compare the averages between the two sets to see any deviation of appeared effectiveness.

Considering the potential alternatives to the current quantitative metrics available, the rubric may provide the most value to gain a quantitative insight from a no-fault exercise.

Conclusion

Throughout the process that included interviews with leading exercise experts and a vast amount of research, this chapter was meant to demonstrate that the methods currently used to evaluate some exercises are insufficient and propose an alternative suite of methods. Ultimately, the question became not if tabletop exercises are effective, but instead how can one gauge the level of effectiveness from a tabletop exercise. If exercise planners have the right tools and are prepared to gauge response, exercise effectiveness should be transparent to the organizations they are preparing.

Another take away in the researching of tabletop exercise effectiveness is that determining effectiveness can be done from qualitative metrics if exercise objectives are clear and the exercise produces lessons learned. Whether it is an emergency manager saying they gained an understanding of the appropriate fire, law enforcement, or medical staff that would be responding to their facility in an actual emergency or it is a police chief that is able to see that their current standard operating procedures will not suffice in a particular disaster, qualitative response can provide great data to determine effectiveness. As these metrics are continually refined, a combination of qualitative and quantitative data may be the most useful to organizations in having an understanding of the level of effectiveness from a tabletop exercise.

Since the suggestions offered to improve quantitative metrics available have little testing, it would be beneficial for organizations to experiment with the suggestions to gauge their use. Additionally, more research and experimenting could be done to identify additional ways of gaining quantitative metrics from a tabletop exercise. Overall, the goal of this chapter is to illustrate a substantial benefit that could be provided by quantifying the effectiveness of an exercise. This could offer substantial evidence with regards to tying the purpose of the exercise provided by senior leadership and the outcomes.

In future research and development in this area, the level of effectiveness should be examined in monetary terms. One area that would bring great interest from both public and private organizations alike would be to develop a return on investment formula to help private organizations with training budgets and assessments, as well as assisting government agencies with budgeting and funding requests.

Thesis Conclusion

Over the course of this paper being developed, the realization was made of how undeveloped the U.S. was in terms of infrastructure, response, planning, and exercises to nuclear and radiological preparedness prior to the turn of the century. Essentially. it is presented in Chapter 1 that the U.S. federal agencies didn't start taking over responsibility and building out infrastructure to prepare for and respond to nuclear and radiological incidents until the start of the 1970s. Comparative to natural disasters like storms, this is an extremely new field of work. Historical context provided that the field didn't start in the 1940s and the preparedness to nuclear and radiological incidents was passed over to Federal agencies from the Department of Defense until the 1970s.

The reactive nature of the U.S. government, and the world for that matter, to nuclear and radiological preparedness is illustrated throughout the chapter by significant incidents like Three Mile Island, Chernobyl and Goiania. Each incident identified different aspects of learning from experience for the U.S. in both response as well as what capabilities are necessary to address the incidents. This is not to point fault, but to illustrate how new the field was. As soon as the U.S. started to get a grasp on the preparedness aspect of nuclear and radiological events with regards to an accident, during the last part of the century showed a rise of intentional attacks and terrorism. This brought the possibility of a new threat to the U.S. not formerly addressed throughout all levels of government in preparing for the intentional use of these materials in an attack. U.S. began to address this in three ways. They makeup of the federal response and licensing agencies involving nuclear and radiological

material evolved and were formed. Agencies such as DOE, NRC, FEMA and others were all formed to protect and respond to incidents involving nuclear and radiological material.

Secondly, various administrations addressed response to potential threats involving these materials by a variety of means to include Reagan's administration forming the VP task force to combat terrorism and the Clinton Administration issuing Presidential Decision Directives such as the PDD 39. Lastly, specialized units were created throughout this 30-year period to include FRMAC and NEST that provided a niche form of disaster response to a relatively new threat. The chapter ended with the U.S. forming NNSA which continues to be a critical organization with its mission of:

> **Maintaining the Stockpile**
> NNSA ensures the United States maintains a safe, secure, and reliable nuclear stockpile through the application of unparalleled science, technology, engineering, and manufacturing.
> **Nonproliferation**
> NNSA works to prevent nuclear weapon proliferation and reduce the threat of nuclear and radiological terrorism around the world. The agency endeavors to prevent the development of nuclear weapons and the spread of materials or knowledge needed to create them.
> **Counterterrorism and Counterproliferation**
> NNSA plays a key role in preventing, countering, and responding to a terrorist or other adversary with a nuclear or radiological device.
> **Powering the Nuclear Navy**
> NNSA provides militarily effective nuclear propulsion plants and ensures their safe, reliable and long-lived operation.[155]

The second chapter focused solely on radioactive materials due to the common availability of them across the U.S. and the slower adoption of security, planning, and response standards around radioactive materials in comparison to

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nuclear material. This chapter illustrated the evolution of the U.S. by the creation of new agencies such as the Department of Homeland Security, new organizations with agencies such as FBI's WMD Directorate; new presidential directives such as HSPD-5, HSPD-8, PPD-8; frameworks such as the National Prevention, Protection, Response, Mitigation, and Recovery Frameworks and systems such as the NIMS and ICS; and agency-specific and Interagency response protocols to better support the security of the material and the response to a potential radiological incident.

To simplify the context of the U.S. radiological security infrastructure as clearly as possible, one could look at it similar to a product lifecycle. Essentially, the beginning of the decade could represent the introduction phase to threats and the U.S. early adoption of practices and infrastructure development. The mid-2000s between 2008 and 2012 being a point of rapid growth with significant resources and government spending being focused on radiological security, to where we are today in a maturity stage. Over the last two decades, the U.S. has significantly addressed the radiological security threat to the point of having the some of the top experts in the world on preparedness and response.

The last chapter of the paper was provided to illustrate a mechanism to test where preparedness is or needs to be. Over the last 50 years, the U.S. has developed and evolved its response to nuclear and radiological incidents. TTXs are used to test the maturity of plans and response. The discussion on tabletop exercises evolved from an introduction to suggesting how these exercises could be improved to better understand if they are actually effective upon completion. This concept is a significant concern for agencies as they validate funding and

government spending. As a result of the research, a rubric was developed to help tie evaluation metrics to exercise objectives to provide a direct numeric assessment on the success of an exercise. This work on developing the rubric and expanding exercise effectiveness is a passion of my company and should be expanded to federal agencies over the next year.

As a result of this paper, it is easy to use hindsight to pinpoint flaws in preparedness. As Mr. Glick summarized this best, “Hindsight is better than 20/20.” I’ve had the privilege to interview and work with the top officials, planners, and response agencies in the field of nuclear and radiological preparedness. It is evident that U.S. agencies are staffed with the best experts in the fields and are on the cutting edge of advancing the country’s preparedness to threats. One can look back at how the U.S. prepared, planned, exercised, or responded to events from a view that stands in time and provides no context to time still moving forward. This paper looks to illustrate that significant changes have been made to improve infrastructure, planning and exercises from lessons learned through the use of historic data, first-hand interviews, and charts to align my argument. It also illustrates that the U.S. has shifted our mindset to one of proactive by evidence throughout infrastructure, planning, and response. With regards to radiological security, this is apparent by ORS’s model currently working worldwide to remove or reduce high-activity radioactive material from facilities could pose a threat to a population if not properly secured. This is also apparent by the changes in U.S. agencies, plans, and how exercises are conducted to include revisions made to the HSEEP guidance and exercise delivery.

Preparedness to nuclear and radiological incidents is constantly evolving. Threats to/from, bad actors, tools used, and impacts change constantly. In order to reduce the risk of great consequence to U.S., the country will have to continue to maintain a proactive approach, enhance interagency coordination and communication methods, train and exercise effectively, and most importantly…use their imagination.

Appendix 1

Exercise Effectiveness

Tasks	Lowest Quality (1 pt)	Average Quality (2 pts)	Best Quality (3 pts)	Score
Were the exercise objectives clear?	Exercise objectives were vague/unclear or were not well stated	some of the exercise objectives were clear while others were not.	Exercise objectives were clear and understandable	
Met Exercise objectives #1 - state objective	Objective 1 was not met or discussed	Objective 1 was partially met	Objective 1 was fully met	
Met Exercise objectives #2 - state objective	Objective 2 was not met or discussed	Objective 2 was partially met	Objective 2 was fully met	
Met Exercise objectives #3 - state objective	Objective 3 was not met or discussed	Objective 3 was partially met	Objective 3 was fully met	
Met Exercise objectives #4 - state objective	Objective 4 was not met or discussed	Objective 4 was partially met	Objective 4 was fully met	
Appropriate response participants were in attendance	Exercise did not have the appropriate participation in attendance	Some of the key agency and participants were in attendance	Almost all of the key agencies and participants participated or were in attendance	
Participation Level	Very little response from exercise players or observers	Moderate level of quality discussion and participation from players and observers	Excellent discussion and response from players and observers	
Were gaps in SOPs, plans or policies identified?	No gaps or problems in response of plans were identified	Some discussion of gaps in plans or procedures were identified	An important gap in a plan, policy, or procedure was identified	
Do you feel others identified lessons learned from the exercise?	There was no mention of learning from other participants	A couple of players indicated that the exercise offered some learning	Several players and observers indicated that the exercise provided them with lessons learned	
Do you feel leadership gained valuable expertise in response to the exercise scenario?	Site leadership and incident command/response seemed bored or unenthusiastic about the scenario	Site leadership and incident response/command enjoyed the scenario	Site leadership and incident command were challenged by the scenario	
Team Building among response assets	All response assets knew one another	Most of the agencies knew one another through normal interaction	The exercise provided a great opportunity to meet response assets who were unknown	
Understanding and clarity of Incident Command	Incident command was not established in the exercise	Incident command was identified a couple of times but was unclear at times who was in charge	Throughout the exercise incident command was well identified and established	
Was the exercise scenario realistic/believable?	The exercise was not well planned or believable	The exercise was some what believable and realistic	Great detail was utilized to provide a realistic and believable scenario	
Did response assets work well together?	Response assets quarreled or did not work well together	Response assets were comfortable working together	All levels of response worked as a team to work through the scenario	
Did the facilitator(s) moderate discussion well?	The facilitator(s) did not moderate discussion or time well	The facilitator(s) did an adequate job of moderating discussion and time	The facilitator(s) did an excellent job at working through issues and asking good follow-on questions	
Did the exercise run smoothly?	The site and/or exercise team was unprepared and appeared unorganized causing some interruption and/or disturbance to the exercise	The exercise had a few technical problems or the exercise seemed a little unprepared	The site and exercise team appeared well organized throughout the day	
Will your organization make any adjustments to SOPs, plans, or procedures due to lessons from the exercise?	The exercise did not provide us with any takeaways to improve our current plans or procedures	Our organization will discuss our current SOPs, plans, and/or polices because of this exercise	Our organization will make an adjustment to a SOP, plan, or policy because of this exercise	
Will your agency/organization increase training in a certain area because of this exercise?	No increase of training will be necessary	Our organization/agency will revisit our training situation because of lessons learned from this exercise	Our organization needs to increase training because of lessons learned from this exercise	
Will your agency partner with another agency to work through an issue because of this exercise?	No work is necessary	Our agency/organization will discuss working through an issue with another agency/organization	Our agency/organization needs to work through an issue with another agency/organization	
Do you feel this site/community is better prepared for a similar situation because of this exercise?	The exercise scenario did not provide any value to the site/community	The exercise provided some value to the site/community	The site/community is better prepared for a disaster because of this exercise	

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Biography

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